THE UNIVERSITY OF ALBERTA

ORDOVICIAN
GEOLOGY OF THE PROPHET RIVER MAP-AREA,
BRITISH COLUMBIA

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

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DEPARTMENT OF GEOLOGY

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Ordovician Geology of the Prophet River Map-area, British Columbia", submitted by Robert Lowell Tedrick, B.Sc., in partial fulfillment of the requirements for the degree of Master of Science.

ABSTRACT

Ordovician rocks northwest of Ft. St. John, British Columbia were deposited in a shallow, marine basin bordering a Precambrian-Cambrian high. The clastic sediments were derived from the northeast and east, and are now found in abundance in the limestones and dolomites which were deposited near the shoreline. Uplift in late Ordovician or early Silurian time removed the Upper and Middle Ordovician sediments in the northeast and part of the Upper Ordovician sediments in the southeast, but did not affect the sediments of the western graptolitic belt until later in Silurian time.

Upper Palaeozoic and Mesozoic rocks, outcropping east of the map-area, have been eroded at various intervals since Silurian time.

The Palaeozoic rocks of the map-area have been folded and thrust to the east along low-angle faults. Locally the time of deformation is known to be post-Lower Cretaceous since Cambrian rocks now overlie those of Cretaceous age.

ACKNOWLEDGMENTS

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INTRODUCTION

General

Much of the geology of northeastern British Columbia is imperfectly known. Because of inaccessibility, the economic development of this area has been slow and the growth in geologic knowledge of the region has been greatly inhibited. The present study concerns the area between the fifty-seventh and fifty-eighth parallels and is an attempt to bring to light some of the information regarding the Ordovician rocks of the Prophet River map-area.

The Prophet River map-area lies approximately 150 miles northwest of Ft. St. John in northeastern British Columbia. It is bounded on the east by a thrust zone; on the west by the Kwadacha and Akie River valleys; on the northwest by the Lloyd George Ice-field; and on the south by the Russell Range and the headwaters of the Ospika River.

The area is underlain by rocks ranging in age from Precambrian to Mesozoic, but only those of Ordovician age are considered in detail in this report.

Location and Accessibility

The entire map-area lies within the Rocky Mountains (Bostock, 1948) which trend from the northwestern corner of the area (58° lat., 125°30' long.) to the southeastern corner (57° lat., 123°30' long.) (Figure 1). The National Topographic System of maps covers the area with sheets 94F (Ware) and 94G (Trutch), both of which are on a scale of 1: 250,000 (approximately 1 inch to 4 miles).

It is possible to go up the Peace River by boat and travel by horseback north into the map-area, but movement by helicopter or float plane is faster and more convenient.

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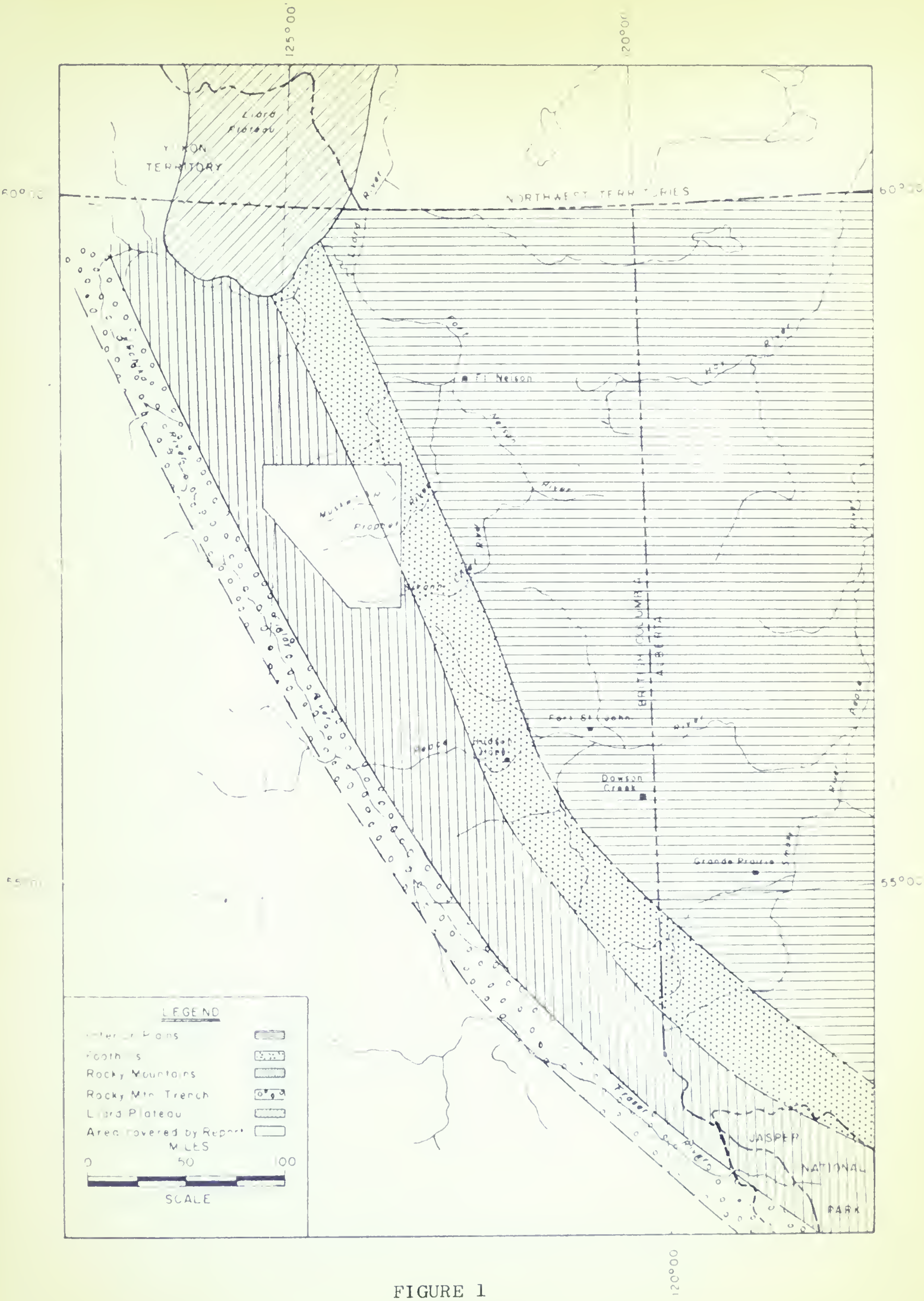


FIGURE 1

INDEX MAP SHOWING LOCATION
OF PROPHET RIVER AREA

Purpose of the Investigation

The investigation was carried out under the direction of Mr. J. P. A. Noble and Dr. P. Stringer while the writer was employed by Pan American Petroleum Corporation. The party was engaged in measuring and mapping Lower Palaeozoic rocks as part of the 1961 summer field project. The main interest was in rocks of Silurian and Devonian age, but the need for general information necessitated the measuring of a number of Ordovician sections, and it was these in which the writer became most interested and chose for his study.

Correlation of the various Ordovician sections became a major problem during the summer because of the wide-spread geographic distribution of the sections, and because of the lack of faunal control within them. It was decided that a study of the structural and sedimentary history of the area might be of considerable value in determining the economic importance of the Lower Palaeozoic sediments and the structures involving them.

Physiography

The Prophet River area lies west of the Foothills in the Rocky Mountains. The Muskwa, Prophet, Besa and Sikanni Chief Rivers drain the eastern half of the area to the Liard River, and the Kwadacha, Akie and the Ospika Rivers drain the western half to the Finlay River.

The northwestern portion of the area is covered by the Lloyd George Ice-field, and in the central part isolated ice-sheets are present. Farther south, a few permanent snow-sheets cover the higher peaks such as Great Snow Mountain and Cyclops Peak.

Except in areas of pronounced folding and overturning, the gentle dips of the Ordovician carbonates give rise to a concentrated, dendritic drainage pattern. Relief averages 2000 to 2500 feet with a maximum local relief of 4000 feet at Cloudmaker Mountain. The highest points in the area, north of Great Snow Mountain and on the northern end of the Lloyd George Ice-field, rise slightly over 9000 feet. The major portion of the drainage emanates from cirques and cirque lakes in the mountain peaks. Hanging valleys are common and many of the smaller streams flow in broad, U-shaped valleys. Two major streams of the eastern region, the Muskwa and Prophet Rivers, flow in broad valleys choked with glacial debris and have meandering paths of streams in the late maturity stage of the geomorphic cycle.

Previous Work in the Map-Area

The first reports on the geology of this general area are those by Dawson (1881), McConnell (1890), Williams (1922), and Dolmage (1927). Later reports include those by Cameron and Warren (1938), Kingston (1950), Williams (1944), Laudon and Chronic (1949) and McLearn and Kindle (1950).

The geologic maps of the Geological Survey of Canada outline the areal coverage of Palaeozoic rocks in this region, but do not show systemic boundaries, and most written publications omit discussion of the Ordovician. Many oil companies have mapped this region, but have not published their findings.

Methods Employed

Stratigraphic sections (Appendix A) were measured by Jacob's staff and Brunton compass where the dip of the strata was fairly low, and with a 100-foot tape where the dip was high and relief low. Samples were

taken at varying intervals dependent largely upon the frequency of lithologic change.

Palaeontologic samples were taken wherever a fauna was found in the rocks. In the eastern area, faunas are scarce and specimens are poorly preserved; whereas the western area has an abundant fauna and the collections from these rocks are extensive.

A total of 20,995 feet was examined, but nowhere within the area was it possible to measure a complete section of Ordovician rocks. This footage is represented by 532 lithologic samples collected from 13 sections. Nine of the sections were measured by the writer and insoluble residues of these and one other section were examined under the binocular microscope by him. Measuring and analyses of the remaining sections were carried out by the other senior members of the field party.

Twenty-three selected thin sections were used to study dolomitization and algal structures.

Pan American Petroleum Corporation has done previous work north of the map-area, and has prepared an unpublished geologic map which was available throughout the four-month field season.

GENERAL GEOLOGY

The Prophet River area lies within the Rocky Mountains of the Canadian Cordillera (Bostock, 1948). A northwest trending low-angle thrust called the Frontal thrust separates the Rocky Mountains from the Foothills, and forms the eastern boundary of the mapped area.

The Frontal thrust raises Cambrian to Devonian rocks, and may be traced almost the length of the map-area. In places it is overridden by a second thrust which has carried Silurian and Ordovician rocks to the east. Time did not permit detailed study of these thrust sheets, and the relationship between the two sheets is not clear south of the Besa River.

The area has had a complex history of structural deformation resulting in the formation of numerous faults, anticlines and synclines. The folds show some degree of overturning to the east, a feature which probably accompanied the thrusting. Regional plunge of the structures is to the southeast, and the intensity of deformation and overturning increases to the east.

Rocks within the area range in age from Precambrian to Upper Devonian with Carboniferous, Permian and Mesozoic strata outcropping to the north and east. Precambrian sedimentary rocks consist of shales, siltstones, sandstones and some carbonates. Cambrian strata are mainly sandstones, quartzites and shales with thick carbonates reported from the Racing River area to the north (Vail, 1957). Rocks of Ordovician and Silurian age are carbonates, shales and marine sandstones. The Ordovician rocks are about 2800 to 3000 feet thick, and the Silurian strata are reported by McLearn and Kindle to reach a maximum thickness of 1200 feet. Devonian sediments are represented only in the eastern

area where 3500 feet of carbonates and marine shales are in faulted contact with Cretaceous strata on the eastern edge of the map-area.

STRUCTURAL GEOLOGY

General

The Rocky Mountains are formed by the erosion of a series of northwest trending, folded, thrust sheets comprised of geosynclinal strata of Precambrian to Mesozoic age (Charlesworth, 1959). The sediments are relatively unmetamorphosed and have been intruded in only a few areas. A series of low-angle thrusts mark the eastern extent of the mountains. To the east, the Foothills intervene between the mountains and the undeformed sediments of the Plains, and the Rocky Mountain Trench forms the western boundary of the mountain belt.

Orogenic activity during the Paleocene and Eocene epochs (Russell, 1954) resulted in uplift, folding and faulting of the geosynclinal sediments, and subsequent erosion has carved the present topography.

Faulting and folding have affected almost the entire area, but two major thrusts are the most prominent of the structural features (Figure 2 in pocket). The easternmost thrust (referred to as the Frontal thrust) has carried sediments of Cambrian to Devonian age eastward over Mesozoic strata. The westernmost thrust (referred to as the Western thrust) has, in places, overridden the Frontal thrust with a sheet of Ordovician and Silurian strata.

Frontal Thrust

The dip of the fault plane is fairly steep throughout, decreasing south of the Prophet River where the fault trace shows a slight response to topography.

Maximum displacement along the fault occurs north of the Muskwa River where Cambrian sediments are thrust over those of Cretaceous age.

Displacement decreases to the south until the fault disappears near Keily Creek and presumably dies out beneath the Western thrust sheet.

Anticlinal folding of the Frontal thrust sheet has exposed Cambrian quartzites between Ordovician carbonates near section RT-2. The structure is doubly plunging so that north of Lillian Creek and south of Tracene Creek, Ordovician sediments of the Western thrust sheet directly overlie Ordovician sediments of the Frontal thrust sheet.

Immediately north of the map-area, the Frontal thrust loses its identity, and a broad zone of thrust faulting is observed on strike with the Frontal thrust south of the Chischa River. Ordovician sediments are no longer present because of post-Ordovician erosion and Precambrian (?) sediments are overlain by Silurian rocks.

Western Thrust

The Western thrust is inferred to be present north of Lillian Creek and is thought to have a steep westerly dip. South of Lillian Creek, the fault is readily apparent and the dip shallows as is shown by the topographic control of the fault trace. Between the Prophet River and Richards Creek, klippen of Ordovician strata are present where erosion has cut through the gently westward-dipping fault plane. The underlying Devonian rocks are now exposed in saddles between isolated Ordovician thrust blocks (Plate 1).

South of Keily Creek, the Western thrust is easternmost and extends to the vicinity of Greiner Creek where an anticline, asymmetric to the east, is in alignment with the fault trace. There is no evidence of displacement and it appears that the thrust dies out into the anticline.

Faults of limited areal extent and lesser displacement occur in the folded belt to the west of the major thrust zone, but, since none were studied in detail, the contact relationships adjacent to the fault traces are not known. Palaeozoic thrust sheets have been mapped east of the present area along the Prophet River, and Palaeozoic strata are shown to be thrust eastward over Triassic strata. Structural relations indicate that Carboniferous sediments are in faulted contact with those of Triassic age. To the east, conformable Jurassic and Cretaceous rocks, affected by folding, place the age of deformation as post-Cretaceous (McLearn and Kindle, 1950).

PLATE 1

Western thrust sheet carried eastward over Devonian carbonates (looking west).

PLATE 1

Western thrust sheet carried eastward over Devonian carbonates (looking west).

STRUCTURAL HISTORY

The structural history of the Canadian Rocky Mountains has been presented by numerous writers, and reference to some of these reports aids the interpretation of the structural events which occurred in the Prophet River area.

In reporting on the Palaeozoic rocks along the Alaska Highway, Laudon and Chronic (1949) indicate that the eastern front of their second physiographic zone is formed by a thrust fault which has carried "Pre-cambrian and early Palaeozoic rocks" eastward over rocks of "pre-Silurian" age. Deformed Lower Cretaceous rocks in the vicinity of Summit Lake, Mile 391, place the age of thrusting there as post-Lower Cretaceous.

The fault mentioned by Laudon and Chronic is in alignment with similar structures observed by the writer and mapped intermittently southward beyond the Prophet River. North of the Muskwa River, Cambrian sediments have been carried eastward over probable Cretaceous rocks along the Frontal thrust. The time of deformation is post-Cretaceous, but no minimum age can be determined from the relationships of the rocks in this area.

Compressional stresses advancing from the southwest developed thrusts and folds in the eastern sandstones and carbonates, and in the less resistant shales and siltstones in the west. Since no structural features were observed in detail in the west, the result of compression of the western sediments is not known. The stress front caused dislocation and overthrusting along the Frontal thrust until frictional drag resulted in folding of the thrust sheet. Continued application of the stress folded the thrust plane, and, in doing so, provided a second zone of weakness along which the stress could be more readily released. With southwestward waning

of the deformational front (Charlesworth, 1959) overthrusting along this weakened zone west of the original thrust, would carry the Western thrust sheet eastward. The strata adjacent to the fault plane would be folded from the overriding action and as the stress system weakened to the southwest it would deform the western sediments.

Russell (1954) indicates that there is evidence for two stages of uplift of the Rocky Mountains. The first occurred in Paleocene time and the second occurred in Eocene time. No detailed structural studies were done in the present map-area, but field evidence indicates the major thrusts and folds were probably formed during a single phase of orogenic activity. This took place some time after the beginning of the Cretaceous period, but may have been modified by later activity. However, the conglomerate fans of the Fort Nelson and Dunvegan Formations, immediately east of the map-area, indicate that there was an early uplift in mid-Cretaceous times at the north end of the Rocky Mountains. This may be an earlier phase of the Laramide than originally recognized.

STRATIGRAPHY

The stratigraphic section exposed in northeastern British Columbia is shown in the following table modified from McLearn and Kindle (1950).

Table of Formations

Age	Formation	Thickness (Feet)	Lithology
Cretaceous*	Dunvegan	500-1000	Marine and non-marine sandstone and shale.
	Fort St. John	4000-5000	Marine shale and sandstone.
	Bullhead group	5000	Non-marine sandstone, shale and coal over marine sandstone and shale.
Jurassic*	Fernie group	1000	Marine shale and sandstone
Triassic*	Schooler Creek	4500-8000	Marine siltstone, limestone, shale and calcareous sandstone.
Permian*			Marine sandstone and chert.
Carboniferous*			Marine shale, sandstone and limestone.
Devonian	Fort Creek and "Ramparts"	1800	Shale and marine limestone.
	Muncho and McConnell	1800	Limestone and arenaceous siltstone.
Silurian	Ronning	1200	Marine, shaly limestone and dolomitic limestone.
Ordovician		2800	Marine limestone, shale, dolomite and sandstone.
Cambrian		3500-5000	Conglomerate, sandstone, shale and limestone.
Proterozoic			Quartzite, argillite, slate, schist and gneiss.

* Do not outcrop in the Prophet River map-area.

Rocks ranging in age from Precambrian to Cretaceous are exposed within the Prophet River map-area, although not in an unbroken sequence. Erosional unconformities omit strata of Lower Silurian, Lower Devonian and Permian ages.

Precambrian strata consist of an unknown thickness of siltstones, shales, sandstones and limestones. Cambrian strata are comprised of tan-weathering sandstones, shales and quartzites which reach a thickness of 4000 feet in the Tuchodi Lakes region. These are overlain by light-grey-weathering limestones, shales and dolomites of Ordovician age which are conformable with Lower Silurian siltstones and shales in the west, but which are overlain unconformably by Lower or Middle Silurian sandstones and quartzites in the east. Fossiliferous Devonian carbonates and clastics rest upon Silurian strata in the east, but have been removed by erosion west of the thrust zone. Younger sediments are in faulted contact with Devonian strata east of the Frontal thrust. Cretaceous rocks were identified in the east, but no detailed examinations were made of these or other Mesozoic sediments.

Much information has been published on the Palaeozoic and Mesozoic rocks of this region (Williams, 1944; Laudon and Chronic, 1949; McLearn and Kindle, 1950), but little work has been done on the Ordovician. The sediments of the Prophet River map-area may be divided into three rock units, A, B, and C (Figures 3 and 4).

Unit A

Unit A, the lowest of the three rock units, consists predominantly of microcrystalline limestone (Appendix B) and is not exposed in full in any of the sections examined. In the northern part of the map-area, pre-Silurian erosion has removed some of the upper portion, and in the southern and western parts, the lower beds are talus covered.

Near the Muskwa River, 1130 feet of limestone outcrops broken by a bed of 45 feet of shale (Appendix A). The shale occurs 250 feet above the base of the section there and has gradational contacts with the limestone above and below.

South of the Sikanni Chief River, the most extensive section of Unit A outcrops. Here 2121 feet of limestone were measured down to the valley bottom. The upper beds show cleavage, but the remainder of the section consists of thick-bedded limestone which shows very little lithologic variation and, like correlative strata to the north, contains a scant trilobite and brachiopod fauna (Figure 3).

The clastic content of this Unit increases to the west and at section DS-19, north of the Akie River, shale and mudstone beds become common. The base of the section is obscured by talus, but 590 feet of interbedded argillaceous limestone, calcareous mudstone and calcareous shale outcrop (Appendix C). To the northwest, the lithology and fossil content are similar and the unit measures about 900 feet in thickness with an undetermined thickness of limestone below the measured section.

Two sections were examined in the central portion of the area and both are mainly limestone. The basal portion of the unit was not measured at section GS-19, but 2000 to 2500 feet of limestone were estimated in addition to the measured 208 feet of limestone, carrying 2 feet of algal dolomite 135 feet from the top. At section GS-18, to the southeast, 2000 feet of argillaceous limestone outcrop, but as the entire section is cleaved and cut by faults of minor displacement, the thickness is not reliable.

The fauna contained within Unit A is divided into three biota--"shelly", algal and graptolitic. The shelly and algal assemblages often

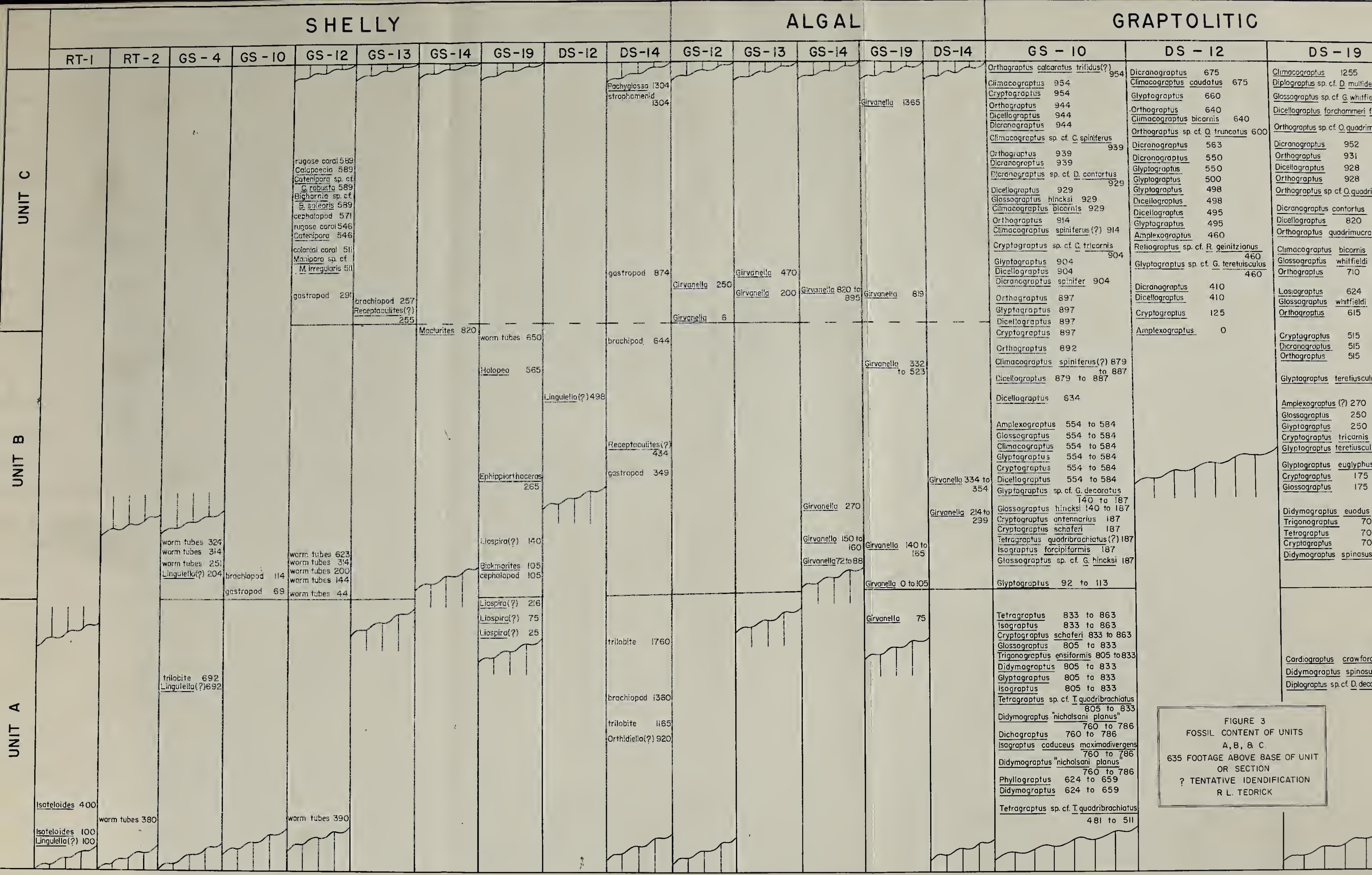


FIGURE 3
FOSSIL CONTENT OF UNITS
A, B, & C.
635 FOOTAGE ABOVE BASE OF UNIT
OR SECTION
? TENTATIVE IDENDIFICATION
R L. TEDRICK

occur together and a few occurrences were found where the shelly suite was preserved with the graptolitic assemblage. However, the specimens of the shelly faunule that occur with the graptolitic suite are fragmental, or if well preserved, are such wide-ranging types that they are of little stratigraphic value.

The shelly biota is found mainly in the eastern sediments and includes inarticulate brachiopods, trilobite fragments and gastropods. The lingulid brachiopods are not definitive in age and the gastropods are unrecognizable, but specimens of the trilobite Isoteloides, indicates a Canadian (Lower Ordovician) age for the basal portions of Unit A.

The algae are found with poorly-preserved gastropods at section GS-19 in a thin dolomite bed. They are best developed in sediments of the eastern area which contain possible correlatives of the Red River and Stony Mountain fauna of southern Manitoba (Nelson, 1959). This last named fauna is considered late Middle or early Upper Ordovician in age so the limestone overlying the algal dolomite at GS-19 may possibly be a part of Unit B. If the limestone is not part of Unit B, then Unit A would transcend the time boundary between Lower and Middle Ordovician and the strata would represent an extremely condensed section of Ordovician, or there is an unconformity in the Middle Ordovician that was overlooked.

The graptolite biota is found only in the western part of the area in thinly-bedded mudstones and shales which are interbedded with unfossiliferous limestone. Lower and Middle Ordovician forms are contained in Unit A, and at one location, fragments of an unidentified trilobite and lingulid brachiopods were found with the graptolites.

Unit B

The second rock unit discriminated overlies the lower limestone unit.

In the northeastern part of the area, the Unit has been entirely removed by erosion, but in the west, the contact is gradational with Unit A.

At sections GS-12 and GS-13, 500 to 600 feet of orthoquartzite and calcareous or dolomitic protoquartzite outcrop. Grain size ranges from very fine to coarse and most grains show some degree of roundness.

The grain size diminishes, in part, to the west to mudstone and shale although some sandy sediments are present. Unit B cannot be distinguished from Unit C in the graptolitic sequence and the total thickness is 750 to 800 feet. Lithologic members are mudstone, shale, orthoquartzite, protoquartzite and dolomite, most of which are thin and grade laterally, and often vertically, into one of the other members.

The "fauna" contained within Unit B of the eastern area consists of "worm tubes" or "borings" with no other organic evidence found. The correlative unit to the west contains an abundant graptolite fauna which ranges in age from Middle to Upper Ordovician. The Upper Ordovician portion in the west probably includes correlatives of Unit C as well.

Unit C

Unit C is more restricted in areal distribution, but where it exists as a separate feature it overlies Unit B with apparent conformity. It is overlain unconformably in the east and conformably in the west by strata of Silurian age.

The eastern sediments are dolomite, algal for the most part, and contain an appreciable amount of clastic material which often occurs as partings within the carbonate. Between Keily Creek and the Sikanni Chief River, the thickness varies from 600 to 623 feet of algal dolomite containing a varying amount of very fine grained, fragmental quartz.

In the southern part of the map-area, no differentiation can be made between Units B and C. The thickness varies, reaching a maximum of 1314 feet, but the amount of clastic material is considerably less than in the west.

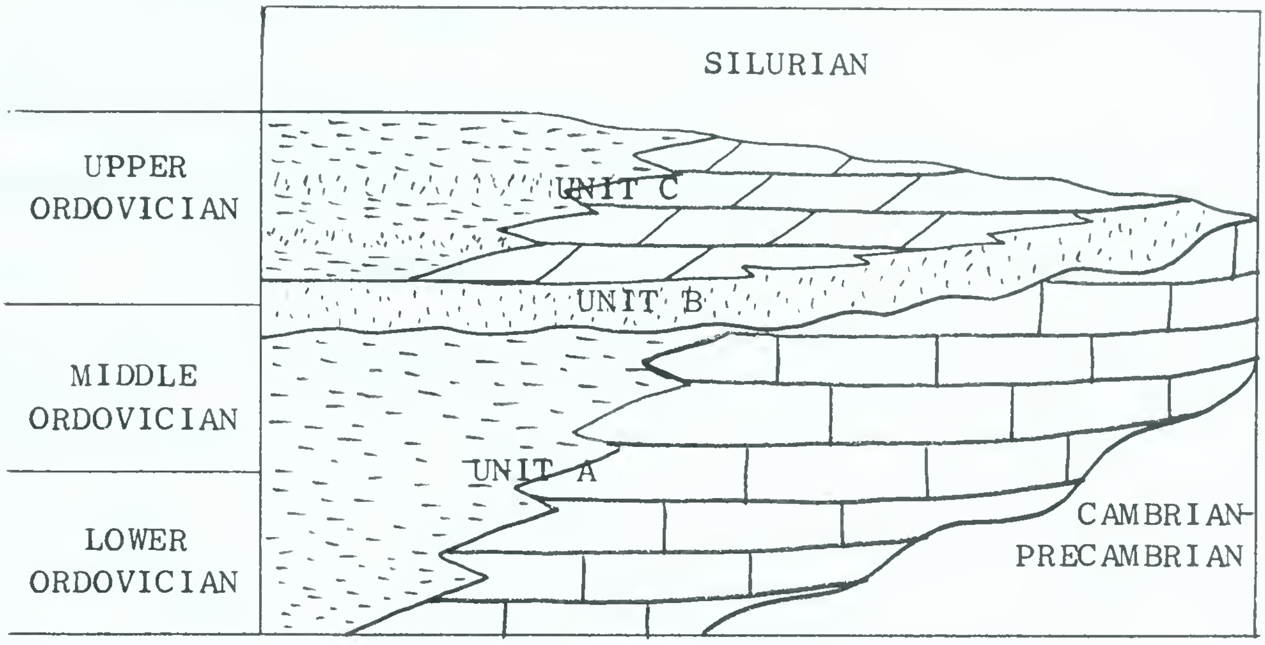
Red River type fossils such as Maclurites, Receptaculites, cateniporid and maniporid type corals and high-spired gastropods are associated with extremely abundant algae in this Unit. Stony Mountain faunal correlatives such as Bighornia cf B. solearis, Catenipora cf C. robusta and maniporid corals are found with some algae, but to a lesser extent. The ages of these fossil groups are possibly Middle to Upper Ordovician.

Time Horizons

Series boundaries are difficult to delineate in these rock units especially in the east where the fauna is poorly preserved or is long-ranging. The graptolites of the western area provide a relatively accurate basis for time horizons, but zonation has been unsuccessful and the boundaries are tentative (Figure 4).

The lower Unit A was deposited during Lower Ordovician time and since Lower and Middle Ordovician graptolites occur mixed in one collection from a thin shale in the western sediments, the upper part of the Unit is probably early Middle Ordovician.

Where it can be recognized individually, Unit B is probably late Middle Ordovician although its gradational contact suggests that the upper portions may extend into Upper Ordovician. If it is acting as a basal sand unit, then homotaxially it would rise in position to the east. This sand member contains no fossils in the east, but it correlates on stratigraphic position with the lower portion of the graptolitic expression of the Unit in the southwest where it contains quartz fragments.



Idealized Geologic Section Showing
Relationship of Rock Units

Figure 4

The eastern expression of Unit C bears late Middle and late Upper Ordovician fossils, and the graptolites of the western part of the unit range from Middle to Upper Ordovician. Unit C probably represents most of Upper Ordovician time. An unknown amount of the upper beds were removed in the east prior to Silurian deposition, but Lower Silurian graptolites in the west indicate that most of the late Ordovician sediments could be present.

Correlations

Immediately north and south of the map-area only Unit A and the dolomite portion of Unit C outcrop. Very little information is available to the south, but northward, the unconformity at the base of the Silurian sediments cuts lower into the underlying strata and Unit C is thus only preserved sporadically. Unit A thins because of erosion and also as a result of a Precambrian-Cambrian high which is discussed in a later section.

Vail (1957) reported thick Ordovician quartzites near the headwaters of the Racing River, north of the map-area. These rocks were assigned an Ordovician age on the basis of stratigraphic position, but were not closely examined in outcrop by him. Near the Racing River, this writer observed Ordovician dolomites, not algal, but similar to rocks of Unit C, underlain by a thick quartzite sequence which is considered in this thesis as Cambrian in age.

South of the Alaska Highway, Ordovician sediments have been completely removed by erosion, but 400 feet of "pre-Silurian" limestone were noted near St. Paul Mountain (Laudon and Chronic, 1949). These strata were not described, but they may be an erosional remnant of Unit A.

Bell (1959) and Borden (1956) established the presence of carbonates of Ordovician age in the lower Mackenzie River area of the Northwest Territories. The section does not appear to be complete, but Upper and probably Middle Ordovician sediments are present. Reports by Hume (1953), Decker, Warren and Stelck (1947) and Jackson and Lenz (1962) dealing with the Yukon and Northwest Territories describe eastern carbonate sediments and western graptolitic sediments and identify them as Ordovician deposits. The carbonate sediments are unconformably overlain by Silurian strata and the graptolitic shales and slates extend into Silurian time with no break in the sequence.

In northwestern British Columbia, Gabrielse (1954) finds the suggestion of a late Ordovician orogeny based on angular relationships between the Ordovician Walker Group and the Ordovician-Silurian Sandpile Group. He further states however, that the angularity may be a result of post-Silurian differential folding and sliding of the older slates, argillites and limestones and the overlying, competent limestones, chert and quartzites.

In the Turnagain River area of northwestern British Columbia, an Upper Ordovician hiatus has been suggested by the absence of graptolite zones in an Ordovician-Silurian shale sequence (Norford in Gabrielse and Wheeler, 1959). This is the only known occurrence of a depositional discontinuance in the graptolitic sediments. Zonation of other faunal collections may reveal similar conditions, although the above occurrence is probably a local phenomenon, or due to collecting.

DEPOSITIONAL HISTORY

Précambrian-Cambrian High

A Precambrian-Cambrian high extends from the headwaters of the Prophet River north to the Racing River and may reach as far as the Alaska Highway west of Summit Lake (Caley, et al, 1961). The erosional resistance of the sediments now form a pronounced topographic high covered with ice and snow. Isolated Ordovician sediments exist within the areal limits of the high, but the feature consists mainly of a core of Precambrian (?) mudstones, sands and carbonates with peripheral Cambrian quartzites and shales.

A Precambrian age has been assigned on the basis of stratigraphic position and a Cambrian age is indicated by tetraxon sponge spicules found in the Upper (?) Cambrian shales near the Prophet River. The Cambrian sediments appear to grade upwards into the lower strata of Unit A, but proof of this observation must await further study of the contact relationship. Cambrian sediments of the high are shales and sandstones and the predominant impurity of the Ordovician carbonate rocks is quartz of sand and silt size. This is not definite proof of emergence, but portions of the high may have been a source of detritus in early Ordovician time.

Post depositional erosion has cut into the sediments around the high so that these no longer give an indication of the early history of the high. Uplift of the high began in early Ordovician times and the central part of this feature supplied a small amount of detritus to the marginal basins. Activity continued throughout Ordovician time and the apparent absence of conglomerates indicates the rate was never great at any time.

The feature may have been emergent during its later history, possibly after the Ordovician period, but it probably was partially submerged throughout the Ordovician. The entire Ordovician sequence of this area consists of shallow-water sediments and their depositional environments could be explained by the presence of the submerged high.

Sedimentary Environment

During much of early Ordovician time, the deposits of this area were interbedded carbonates and fine-grained clastics. There was open circulation in the east under conditions conducive to growth of a shelf-type fauna and limestone accumulated in the quiet waters. Locally, restricted basins were accumulating muds which preserved an extensive graptolite fauna. Shallow-water sedimentary features and the presence of clastic impurities in the carbonates indicate relatively shallow water in which these western muds accumulated.

The carbonates of the east change laterally westward to carbonates, shales and mudstones suggesting that the source of the sediments might be to the west in the direction of increasing grain size. Central and western British Columbia however, were occupied by an extensive eugeosyncline with no major land mass emergent (Gabrielse and Wheeler, 1960), and the terrigenous material was carried into the western basin from the high area. Some restriction, a low sill or a submarine current, barred the terrigenous material from the eastern basin, allowing the accumulation of lime muds.

The source of clastic material during early Ordovician time was probably pre-existing Cambrian and possibly Precambrian sediments to the northeast. The absence of igneous and metamorphic minerals in the carbonate residues and the presence of abundant quartz fragments indicates that the

sediments were not derived from the Precambrian shield, but from Cambrian or Proterozoic sandstones.

There was little change in the Ordovician geography until the latter part of the Middle Ordovician. A new source then arose or there was a rejuvenation of the old source area. Relief was quite low until this time and finely crystalline carbonates were the main deposits. Uplift then occurred to the east or northeast to supply the material, mostly quartz, for the quartzite beds in the east-central portion of the area. Dolomites were being deposited to the north and south coeval with the clastics of the area, and the areal restriction of these sands indicates that a river discharged coarser material into a shallow bay while the finer material was carried to the west in an intermittent supply, to be deposited during times of non-carbonate deposition.

The Middle Ordovician shelly fossils of this area are correlatives of the fauna of southern Manitoba. These are late Middle or early Upper Ordovician forms and the thin sedimentary sequence in which they are found in the present area may indicate a withdrawal of the seas during Middle Ordovician time. There is no evident erosional surface which supports this contention, but the interbedded limestone and dolomite sequence in the central portion of the map-area does suggest that sedimentation continued into Middle Ordovician time before retreat of the seas.

The algae, preserved with the shelly fauna, are reported to flourish in a lightly agitated environment with a water depth of less than 75 feet (Johnson, 1962) and only a slight change of water depth or uplift of the area would be enough to stop algal growth.

Conditions remained unchanged in Late Ordovician time except that the outline of the eastern shoreline changed so that the sand-sized material was swept farther west and the lime muds accumulated in the east.

Withdrawal occurred in Richmondian time affecting the northeastern part of the province and the southern portion of the Northwest Territories. The seas retreated to the north and possibly to the south, but never left the graptolite belt unless locally such as near the Turnagain River area. Complete faunal assemblages throughout most of the western region indicate that deposition was continuous into Silurian time.

Erosion was extensive over much of the eastern map-area during early Silurian time. The earliest fossils recorded from these sediments are those of Niagaran (Middle Silurian) age. The fossils are commonly found in dolomites interbedded with a sandstone member which were deposited over Upper Ordovician to Precambrian (?) strata as the sea advanced to the northeast.

CONCLUSIONS

Early Ordovician time is represented in the Prophet River area by a thick limestone sequence which, because of a fluctuating sea-level, is interbedded with shallow-water clastic sediments to the west. Conditions changed very little in Middle Ordovician time. An eastern source area was supplying coarse clastics to the central part of the eastern basin while shallow-water carbonates were being deposited to the north and south. Some stabilization of the western part of the basin is evidenced by the absence of carbonates. Sedimentation may not have been complete during Upper Ordovician time before pre-Silurian erosion began removing the deposits of the eastern sea. The western sediments were not affected by the uplift and the depositional record extends into Silurian time.

The Western thrust developed from folding of the Frontal thrust plane sometime after the beginning of the Cretaceous period. The overriding action of the Western thrust sheet has produced a complex structural pattern in the rocks of the map-area.

BIBLIOGRAPHY

Bell, W. A. (1959) Stratigraphy and Sedimentation of Middle Ordovician and Older Sediments in the Wrigley-Fort Norman Area, Mackenzie District, N.W.T.; Can. Min. and Metall. Bull. vol. LXII.

Borden, R. L. (1956) An Upper Ordovician Coral Fauna, Lower Mackenzie River Area, N.W.T.; Unpub. M.Sc. thesis, Univ. of Alberta.

Bostock, H. S. (1948) Physiography of the Canadian Cordillera, with Special Reference to the Area North of the Fifty-fifth Parallel; Geol. Surv. Canada, Mem. 247.

Caley, J. F., Fortier, W. O., Morley, L. W., Robinson, S.C., and Weeks, L.J. (1962) Information Circular No. 5, Field Work, 1961; Geol. Surv. Canada.

Cameron, A. E. and Warren, P. S. (1938) Geology of South Nahanni River, N.W.T.; Canadian Field Nat., vol. LII, no. 2, pp. 15-18.

Charlesworth, H. A. K. (1959) Some Suggestions on the Structural Development of the Rocky Mountains in Canada; Alberta Soc. Pet. Geol. Jour., vol. 7, no. 11, pp. 249-256.

Dawson, G. M. (1881) Report on an Exploration from Port Simpson on the Pacific Coast to Edmonton on the Saskatchewan, Embracing a Portion of the Northern Part of British Columbia and the Peace River Country; Geol. Nat. Hist. Surv., Canada, Rep't. of Prog., (1879-80) pt. B.

Decker, C. E., Warren, P. S. and Stelck, C. R. (1947) Ordovician and Silurian Rocks in Yukon Territory Northwestern Canada; American Assoc. Pet. Geol. Bull., vol. 31, no. 1, pp. 149-155.

Dolmage, V. (1927) Finlay River District, British Columbia; Geol. Surv. Canada, Summ. Rep't., pt. A (1928).

Gabrielse, H. (1954) McDame, British Columbia; Geol. Surv. Canada, Paper 54-10.

Gabrielse, H. and Wheeler, J. O. (1960) Tectonic Framework of Southern Yukon and Northwestern British Columbia; Geol. Surv. Canada, Paper 60-24.

Hume, G. S. (1953) The Lower Mackenzie River Area, Northwest Territories and Yukon; Geol. Surv. Canada, Mem. 273, pp. 13-14.

Jackson, D. E. and Lenz, A. E. (1962) Zonation of Ordovician and Silurian Graptolites of Northern Yukon, Canada; American Assoc. Pet. Geol. Bull., vol. 46, no. 1.

Johnson, J. H. (1962) Limestone-Building Algae; Colorado School of Mines, 308 pp.

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[illegible]

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[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Laudon, L. R. and Chronic, B. J. (1949) Palaeozoic Stratigraphy Along Alaska Highway in Northeastern British Columbia; American Assoc. Pet. Geol. Bull., vol. 33, no. 2, pp. 189-195.

McLearn, F. H. and Kindle, E. D. (1950) Geology of Northeastern British Columbia; Geol. Surv. Canada, Mem. 259.

McConnell, R. G. (1890) Report on an Exploration in the Yukon and McKenzie Basins, N.W.T.; Geol. Surv. Canada, Ann. Rep't., 1888-89, vol. IV, pt. D.

Nelson, S. J. (1959) Guide Fossils of the Red River and Stony Mountain Equivalents (Ordovician); Alberta Soc. Pet. Geol. Jour., vol. 7, no. 3, pp. 51-61.

Russell, L. S. (1954) The Eocene-Oligocene Transition as a Time of Major Orogeny in Western North America, Trans. Roy. Soc. Canada, Ser. III, vol. 48, sec. IV.

Vail, J. R. (1957) Geology of the Racing River Area, British Columbia; Unpub. M.Sc. thesis, Univ. of British Columbia.

Williams, M. Y. (1922) Reconnaissance Across Northwestern British Columbia and the Geology of the Northern Extension of Franklin Mountains, N.W.T.; Geol. Surv. Canada, Summ. Rep't. pt. B.

Williams, M. Y. (1944) Geological Investigations Along the Alaska Highway from Fort Nelson to Watson Lake, Yukon; Geol. Surv. Canada, Paper 44-28.

A P P E N D I X A

STRATIGRAPHIC SECTIONS

The following stratigraphic section descriptions employ the grain size scales and colours listed below:

Clastic Particles - Wentworth Scale (Folk, 1959, p. 24).

Carbonate Rocks - Brief Summary of Methods and Instructions of Microscope Examination of Well Cuttings and Cores (Lapp, 1958).

Rock Colours - Rock Colour Chart (Goddard, 1948).

White	N9
Black	N1
Light grey	N7
Medium Grey	N5
Dark Grey	N3
Brownish Grey	5YR 4/1
Greenish Grey	5GY 6/1
Light Brownish Grey	5YR 6/1
Pale Brown	5YR 5/2
Light Brown	5YR 5/6
Light Brown	5YR 6/4
Moderate Brown	5YR 4/4
Greyish Blue	5PB 5/2
Yellowish Grey	5Y 7/2
Light Bluish Grey	5B 7/1
Pale Reddish Brown	10R 5/4
Greyish Orange	10YR 7/4
Greyish Pink	5R 8/2
Moderate Yellowish Brown	10YR 5/4

Section: Lillian Creek RT-1

Age: Lower Ordovician to Cambrian

Location: North of Muskwa River at latitude 57°50' N. and east of Lillian Creek at longitude 124°06' W.

Stratigraphic Summary: Silurian quartzites unconformably overlie Ordovician limestones, dolomites and shales; underlain unconformably by Cambrian sandstones and quartzites.

Measured by: R. Tedrick and M. Van Vliet, June 13-16, 1961

Stratigraphic Interval	Thickness (Feet)	Lithology
	LOWER ORDOVICIAN	
Top 1795-1840	45	Limestone - black, weathers moderate brown, cryptocrystalline, medium bedded.
1840-1865	25	Limestone - same as above, but arenaceous and slightly platy, contains pyrite blebs.
1865-1875	10	Limestone - dark grey, weathers dark grey with brownish grey dolomitic interbeds.
1875-2010	135	Limestone - dark grey, weathers light grey, cryptocrystalline, 6-8 foot units with 3-6 inch interbeds of limestone of same colour; pyrite blebs at 1950'.
2010-2075	65	Limestone - black, weathers light grey, cryptocrystalline, 2-5 foot beds with 2-8 inch interbeds of laminated and crossbedded limestone, arenaceous at 2060'.
2075-2150	75	Limestone - light grey, weathers light brown, cryptocrystalline, 2-5 foot beds containing 3-6 inch calcite veins.
2150-2240	90	Limestone - dark grey, weathers light grey, fine crystalline, 12-18 foot beds, arenaceous at 2160'.
2240-2600	360	Limestone - dark grey, weathers mottled light and dark grey, cryptocrystalline, 3-8 inch beds; at 2350' weathers light brown and is thick bedded, 12-20 foot with $\frac{1}{2}$-2 inch calcite stringers parallel to bedding, $\frac{1}{4}$ inch shale partings at 2380' and at 2500' the shale is 2-4 inches thick and occurs every 12-15 feet.

2600-2675	75	Limestone - light brown weathers medium to light grey; fine crystalline; 6-10 foot beds with interbeds of calcareous shale ½-2 inches thick.
2675-2720	45	Shale - greenish grey, weathers light grey, fissile to blocky with interbeds of shaly limestone.
2720-2875	155	Limestone - medium grey, weathers light grey, 4-6 foot beds, argillaceous.
2875-2950	75	Limestone - dark grey, weathers light grey, cryptocrystalline, 2-4 inch beds with ½-4 inch calcite veins at 2880', beds thinner at 2900' -- ½-4 inches and thicker at 2915' -- 6-24 inches.
2950-2970	20	Limestone - light grey, weathers light brown, fine crystalline, 2-6 foot beds containing isolated calcite crystals.
		CAMBRIAN
2970-3000	30	Sandstone - white, weathers light brown, medium grained, 10-12 foot beds.
		Base talus covered.

Section: Tracene Creek RT-2

Age: Lower Ordovician to Cambrian

Location: North of Muskwa River at latitude 57°46'15" N., and east of Tracene Creek at longitude 124°04' W. Measured down northwest face of an unnamed mountain. Correlates to 2222' on section GS-4.

Stratigraphic Summary: Ordovician limestone with minor zone of cross-bedded laminae and intraformational breccia; overlies Cambrian quartzites which are pink-white and thick bedded; base of Cambrian not seen.

Measured by: R. Tedrick and K. Samis, July 2, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	LOWER ORDOVICIAN	
Top 0-33	33	Limestone - greyish blue, weathers mottled light-medium grey, crypto to fine-crystalline, argillaceous, thin to medium bedded.

33-88	55	Limestone - medium grey, weathers white and medium grey, cryptocrystalline, argillaceous.
88-155	67	Limestone - medium grey, weathers medium grey, cryptocrystalline, interbedded 1-3 inch and 10 foot beds, argillaceous, iron stain at 88'.
155-239	84	Limestone - medium grey, weathers light to medium grey, cryptocrystalline near top to fine crystalline at base, wavy bedded in part, 1-18 inch beds, slightly arenaceous at 178', cross-bedded, argillaceous, laminae at 199', iron stained and cleaved at 215'.
239-314	75	Limestone - medium to dark grey, weathers light grey, crypto to fine crystalline, ½-12 inch beds, 3-6 inch zones of intraformational breccia 239'-251' and pyrite blebs at 252'.
314-603	289	Limestone - medium to dark grey, weathers light grey, crypto to fine crystalline, 2-24 inch beds, argillaceous, iron-oxide stain at 418' with argillaceous laminae 418'-425'.
603-613	10	Covered interval.
613-643	30	Limestone - medium grey, weathers light grey, fine crystalline, alternating 6-8 inch and 2-4 foot beds, very arenaceous with occasional argillaceous laminae.
	CAMBRIAN	
643-688	45	Quartzite - pink, weathers white, very fine grained, 1-3 foot beds.
688-720	32	Sandstone - white to medium grey, very fine grained, 2-6 foot beds, calcite stringers at 688'-690'.
		Base talus covered

Section: South Muskwa GS-4

Age: Middle Ordovician to Lower Ordovician

Location: Ridge top about 1/8 mile southwest of RT-2 at latitude 57°45'30" N., and longitude 124°03' W. GS-4 at 2222' correlates with 0' on RT-2

Stratigraphic Summary: Interbedded dolomite and cross-bedded limestone with a siltstone bed near the top; Middle Ordovician dolomite, limestone, and siltstone underlain by Lower Ordovician limestone to top of RT-2.

Measured by: G. Steen and R. Tedrick, June 22-24, 1961.

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Stratigraphic Interval	Thickness (Feet)	Lithology
	MIDDLE ORDOVICIAN	
Top 1385-1474	89	Dolomite - medium grey, weathers brownish grey, cryptocrystalline, 6 inch beds, siliceous stringers throughout.
1474-1485	11	Sandstone - medium grey, weathers medium grey, very fine grained, slightly calcareous.
1485-1517	32	Dolomite - medium grey, weathers brownish grey, fine crystalline, 8-12 inch beds, slightly argillaceous with hematite at 1485'.
1517-1525	8	Limestone - light brownish grey, weathers brownish grey, fine crystalline, 6-10 inch beds, slightly argillaceous.
1525-1537	12	Dolomite - medium grey, weathers brownish grey, fine crystalline, 8-12 inch beds, argillaceous laminae with 3 inch band of intraformational breccia at 1535'.
1537-1666	129	Limestone - dark grey, weathers brownish grey, cryptocrystalline, 2-20 inch beds, argillaceous with cross-bedded, laminae at 1538', pyrite blebs at 1610'.
1666-1700	34	Siltstone - medium grey, weathers brownish grey, 10 inch beds, slightly calcareous and argillaceous.
1700-1841	141	Dolomite - medium grey, weathers light brownish grey, fine crystalline, 2-4 foot beds, argillaceous, calcite-line vugs at 1708' and white chert nodules (2 X 6 inches) at 1742', very argillaceous at 1805'.
	LOWER ORDOVICIAN	
1841-1939	98	Limestone - medium grey, weathers medium grey, cryptocrystalline, 8-12 inch beds, argillaceous.
1939-1951	12	Dolomite - medium grey, weathers medium grey, cryptocrystalline, 8-12 inch beds, argillaceous laminae.
1951-1965	14	Limestone - medium grey, weathers brownish grey, cryptocrystalline, 4-10 inch beds, argillaceous with a 3 foot calcareous siltstone at 1962'.

1965-1977	12	Dolomite - medium grey, weathers light brownish grey, cryptocrystalline, laminated, iron-oxide stain at 1970'.
1977-2222	245	Limestone - medium to dark grey, weathers brownish to light grey, cryptocrystalline, 1-4 inch beds at top and base, 4-20 foot beds in middle of unit, argillaceous, iron-oxide stain at 2150' and cross-bedded laminae at 2173'.
		Base correlates to 0' on RT-2.

Section: Cloudmaker Mountain GS-10

Age: Upper Ordovician to Lower Ordovician

Location: North slope of Cloudmaker Mountain, north of Chesterfield Lake. Measured from mountain top at latitude 57°46' N., and longitude 125°06' W.

Stratigraphic Summary: Lower Ordovician limestone overlain conformably by graptolitic shales and siltstones of Lower to Upper Ordovician in age with conformable Silurian graptolitic shales above.

Measured by: G. Steen and M. Van Vliet, July 10-12, 1961

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER ORDOVICIAN	
Top 1235-1450	215	Shale - dark grey, weathers black, fissile, iron-oxide stain.
1450-1530	80	Shale - dark grey, weathers greyish blue, brownish grey, blocky to fissile.
	MIDDLE (?) ORDOVICIAN	
1530-1605	75	Shale - dark grey, weathers black, iron-oxide stain, fissile.
1605-1926	321	Shale - dark grey, weathers brownish grey with dark greyish brown shale 1605'-1635', fissile.
1926-1936	10	Siltstone - dark grey, weathers light grey, 8 inch bed with conchoidal fracture, limonite blebs 1935'-1936'.
1936-1991	55	Shale - dark grey, weathers brownish grey, fissile.

1991-2002	11	Dolomite - medium grey, weathers light brownish grey, cryptocrystalline, 1-3 foot beds, black chert blebs and bands 1-3 inches thick, very argillaceous.
2002-2047	45	Shale - medium grey, weathers brownish grey, fissile, 3 inch band of black chert.
	LOWER ORDOVICIAN	
2047-2069	22	Dolomite - medium grey, weathers light brownish grey; 8-12 inch black chert bands at 2047' and 2052' and slump fragments of dolomite.
2069-2073	4	Shale - dark grey, weathers brownish grey, platy.
2073-2076	3	Dolomite - medium grey, weathers light brownish grey, 6 inch bed black chert at 2073'.
2076-2097	21	Shale - dark grey, weathers brownish grey.
2097-2151	54	Dolomite - medium grey, weathers light brownish grey, chert nodules 2097'-2102', penecontemporaneous breccia at 2145'.
2151-2156	5	Shale - dark grey, weathers brownish grey, platy.
2156-2189	33	Siltstone - dark grey, weathers greyish blue, 1-24 inch beds, slightly calcareous.
2189-2207	18	Limestone - dark grey, weathers light grey, very argillaceous, appears to grade from above siltstone.
2207-2238	31	Shale - dark grey to brownish grey, weathers light brown, slightly calcareous at 2217', 3 inch siltstone bed at 2237'.
2238-2265	27	Shale - dark grey to brownish grey, weathers light brown, ½-3 inch calcareous siltstone beds laminated and ripple marked.
2265-2284	19	Limestone - dark grey, weathers greyish blue, cryptocrystalline, 6-8 inch beds, interbeds of 1-2 foot siltstone beds.
2284-2344	60	Shale - brownish grey, weathers light grey, conchoidal fracture, very calcareous.
2344-2347	3	Limestone - dark grey weathers light bluish grey, cryptocrystalline, argillaceous laminae.

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2347-2395	48	Shale - brownish grey, weathers light grey, calcareous.
2395-2411	16	Limestone - dark grey, weathers light bluish grey, cryptocrystalline, argillaceous.
2411-2446	35	Shale - dark grey, weathers light brownish grey, cleaved, calcareous, 6 inch interbeds of limestone as at 2395'.
2446-2490	44	Limestone - dark grey, weathers bluish grey, cryptocrystalline, ½-3 inch beds, argillaceous laminae.
2490-2519	29	Limestone - dark grey, weathers bluish grey, cryptocrystalline interbeds of dark grey shale.
2519-2602	83	Shale - dark grey to brownish grey, weathers yellowish brown, fissile, very calcareous near top, less calcareous below.
2602-2625	23	Shale - dark brownish grey, weathers yellowish brown, 4 inch beds, slightly calcareous, cleaved, numerous thin quartz veins, zone of limestone nodules 6"-10" X 1" at 2620'.
2625-2703	78	Shale - dark grey, weathers brownish grey, 10-20 inch beds, cleaved, calcareous, numerous limestone nodules as at 2620'. Nodular limestone with "mudcracked" surface at 2640'.
2703-2718	15	Limestone - nodules coalesce into lenticular beds with intervening shale.
2718-2775	57	Shale - dark grey, weathers brownish grey, 10-20 inch beds, cleaved.
2775-2900	125	Limestone and Shale - ½-3 inch beds, shale predominant below 2800', 1 foot limestone bed at 2840'.
2900-3070	170	Limestone and Shale - 3 inch limestone at 2900' but otherwise ½ inch beds, shale is very calcareous and phyllitic.
		Base - Limestone below not measured.

Section: Van Steen Ridge GS-12

Age: Upper to Lower Ordovician

Location: South of Richards Creek on the west flank of an unnamed mountain at latitude 57°32'30" N., and longitude 123°57' W.

Stratigraphic Summary: Algal dolomite overlying and interbedded with thick sandstones bearing "worm tubes"; non-fossiliferous Lower Ordovician conformably underlying and not measured to the Cambrian.

Measured by: G. Steen and M. Van Vliet, July 17 and 18, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER AND MIDDLE ORDOVICIAN	
Top		
1432-1467	35	Dolomite - dark grey, weathers medium grey, cryptocrystalline, 1-2 foot beds, argillaceous, arenaceous laminae at 1440'.
1467-1528	61	Dolomite - medium grey, weathers medium grey, fine crystalline, 2-24 inch beds, argillaceous, chert bodies at 1510'.
1528-1659	131	Sandstone - light brown, weathers light brownigh grey, fine to medium grained, 1-4 foot beds, subrounded grains, cross-beds 1528'-1550'.
1659-1690	31	Dolomite - medium grey, weathers light grey, microcrystalline, 6-24 inch beds, arenaceous.
1690-1775	85	Dolomite - medium grey, weathers light brown, cryptocrystalline, medium grained "floating" quartz grains, 6-24 inch beds, 10 inch band of vugs at 1725'.
1775-1795	20	Sandstone - white, weathers medium grey, medium grained, 1-2 foot beds, argillaceous partings.
1795-1840	45	Dolomite - medium grey, weathers medium to light brownish grey, cryptocrystalline, 8-10 inch beds, laminae of very fine to fine grained quartz grains.
1840-1841	1	Sandstone - dark grey, weathers dark grey, very fine to medium grained, argillaceous.
1841-2021	180	Dolomite - medium grey, weathers medium to light brownish grey, fine crystalline, 1-12 inch beds, arenaceous laminae, chert nodules at 1870', white chert lenticules and siliceous shell (?) fragments at 1944'.

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2021-2428	407	Sandstone - light brownish grey to light grey, weathers brownish grey, very fine to fine grained, 1-2 foot beds, cross bedded at 2180', abundant argillaceous partings up to ½ inch.
2428-2458	30	Sandstone - white to light grey, weathers white to light brownish grey, very fine grained, 6-20 inch beds.
2458-2461	3	Quartzite - white, weathers light grey.
2461-2644	183	Sandstone - medium grey, weathers brownish grey, very fine to fine grained, 6-24 inch beds to 2500' then 4-10 foot beds to 2644', argillaceous laminae throughout, slightly calcareous 2568'-2644' with pyrite crystals at 2600'.
	LOWER ORDOVICIAN	
2644-2915	271	Limestone - medium to dark grey, weathers yellowish brown, cryptocrystalline, 4-12 foot beds with ¼-½ inch siliceous laminae.
2915-3451	536	Limestone - medium grey, weathers mottled light to medium grey, cryptocrystalline, arenaceous laminae, pyrite cubes at 3090'.
3451-3750	299	Limestone - medium grey, weathers light brownish grey, cryptocrystalline, chert nodules every 30-50 feet; at 3575' the laminae becomes so numerous as to form 2-4 inch calcareous sandstone beds.
3750-3964	214	Limestone - medium grey, weathers light brownish grey, cryptocrystalline, chert and sandstone lenses throughout.
3964-4000	36	Limestone - medium grey, weathers medium grey, cryptocrystalline, 6 inch-2 foot beds.
		Base - Limestone below, not measured but 500-700 feet estimated to valley bottom.

Section: Redfern Mountain GS-13

Age: Upper (?) to Lower Ordovician

Location: Northern slope of Redfern Mountain. Measured down to a tributary of the Besa River at latitude 57°24'30" N., and longitude 123°54' W.

Stratigraphic Summary: Algal dolomite may be part Upper Ordovician overlying Middle (?) Ordovician sandstone which overlies Lower Ordovician limestone. Section was measured down the axis of an anticline and base is not exposed. Silurian overlies the section unconformably and underlying contacts are not exposed.

Measured by: G. Steen, M. Van Vliet and K. Samis, July 20-22, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
		UPPER AND MIDDLE ORDOVICIAN
Top 2230-2390	160	Dolomite - medium grey, weathers light brownish grey, crypto to fine crystalline, 6 inch-2 foot beds, black chert nodules at 2375'.
2390-2480	90	Covered interval, probably dolomite as above.
2480-2640	160	Dolomite - medium grey, weathers light brownish grey, crypto to fine crystalline, chert bands at 2480'-2482'.
2640-2725	85	Covered interval, probably dolomite as above.
2725-2782	57	Dolomite - medium grey, weathers brownish grey, cryptocrystalline, laminae of fine grained quartz throughout.
2782-2815	33	Covered interval, probably dolomite as above.
2815-2830	15	Dolomite - medium grey, weathers light brownish grey, cryptocrystalline, 1-4 foot beds, very arenaceous.
2830-3098	268	Sandstone - light grey, weathers light brownish grey, very fine grained, 1-4 foot beds, dolomitic near top with argillaceous partings near base.
3098-3104	6	Quartzite - white to light grey, weathers light brown.
3104-3215	111	Sandstone - similar to 2830 but less dolomitic.
3215-3240	25	Quartzite - white, weathers yellowish grey, 3-5 foot beds.
3240-3363	123	Sandstone - medium grey, weathers tan grey, fine grained, 3-12 foot beds, numerous argillaceous partings, slightly calcareous with occasional pyrite blebs.

LOWER ORDOVICIAN

3363-3564	201	Limestone - dark to medium grey, weathers light grey to yellowish brown, cryptocrystalline, pyrite cubes at 3495'.
		Section terminated in core of anticline.

Section: North Sikanni Chief River GS-14

Age: Upper to Middle Ordovician

Location: South flank of Mount Helen, four miles north of the Sikanni Chief River at latitude 57°13' N., and longitude 123°53' W.

Stratigraphic Summary: Silurian-Ordovician contact possibly at 2130 feet and the overlying sandstone may be all Silurian which is structurally concordant but appears to be unconformable. Section was measured down axis of an anticline and no Lower Ordovician was encountered.

Measured by: G. Steen and M. Van Vliet, July 24 and 25, 1961

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER AND MIDDLE ORDOVICIAN	
Top 2130-2175	45	Dolomite - light brownish grey, weathers light brown, crypto to fine crystalline, 6-24 inch beds.
2175-2225	50	Covered interval, probably dolomite.
2225-2285	60	Dolomite - dark to medium grey, weathers brownish grey, cryptocrystalline, 1-12 inch beds, argillaceous partings and scattered quartz grains.
2285-2345	60	Covered interval, probably dolomite.
2345-2590	245	Dolomite - dark to medium, weathers medium to light grey, cryptocrystalline, 6 inch-3 foot beds with 3-12 inch black chert bands at 2515' to 2590'.
2590-2640	150	Covered interval, probably dolomite.
2640-3260	620	Dolomite - medium grey, weathers medium grey, fine crystalline, 1-4 foot beds.

3260-3410	150	Dolomite - dark to medium grey, weathers dark to medium grey, fine crystalline, 6-24 inch beds, numerous argillaceous partings 3338'-3410'.
		Section terminated in core of anticline.

Section: Mount April GS-18

Age: Lower Ordovician

Location: Three miles north of the Prophet River. Measured down an escarpment of Ordovician and Cambrian strata at latitude 57°36'30" N., and longitude 124°15' W.

Stratigraphic Summary: Cleaved, phyllitic, limestone of Lower Ordovician age conformably overlying Cambrian sandstones and shales. Ordovician may be thickened by faulting.

Measured by: G. Steen, M. Van Vliet and K. Samis, August 3 and 14, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	LOWER ORDOVICIAN	
Top 0-163	163	Phyllitic limestone - medium grey, weathers light grey, scattered pyrite blebs.
163-475	312	Limestone - medium grey, weathers dark to medium grey, highly cleaved but with uncleaved limestone beds 1-3 feet thick.
475-490	15	Shear zone with abundant secondary calcite and drag folding.
490-525	35	Limestone - dark grey, weathers brownish grey, cryptocrystalline, 2-6 foot beds, argillaceous and slightly cleaved.
525-530	5	Fault zone, secondary calcite. Movement parallel to bedding.
530-635	105	Limestone - dark grey, weathers brownish grey, cryptocrystalline, argillaceous, scattered pyrite crystals at 550', prominent cleavage.
635-645	10	Shear zone with secondary calcite. Movement parallel to bedding.
645-900	255	Limestone - dark grey, weathers dark to medium grey, cryptocrystalline, argillaceous laminae, movement parallel to bedding at 720' and 762'.

900-1890	990	Limestone - dark grey, weathers dark grey, cryptocrystalline, movement parallel to bedding at 905', 970', 980', 1015' and 1193'. Occasional veins of secondary calcite and patches of pyrite throughout.
1890-1905	15	Limestone - sheared and folded; offset appears to be in tens of feet.
1905-1915	10	Sandstone - medium grey, weathers dark grey, very fine grained, abundant pyrite cubes.
1915-2000	85	Limestone - dark grey, weathers dark grey, cryptocrystalline, argillaceous; at 1920' a 1 foot bed of pyritic sandstone.

Section: East Fern Lake GS-19

Age: Upper to Lower Ordovician

Location: East of Fern Lake near a glacier west of Mount Sheffield at latitude 57°45' N. and longitude 124°43' W.

Stratigraphic Summary: Ordovician algal dolomite and limestones exposed at the surface conformably overlying Lower Ordovician limestones. Total Lower Ordovician was not measured but approximately 2000 to 2500 feet of limestone were estimated.

Measured by: G. Steen and K. Samis, August 4, 1961

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER AND MIDDLE ORDOVICIAN	
Top 0-15	15	Dolomite - dark grey, weathers dark grey, fine crystalline, 4-18 inch beds.
15-20	5	Limestone - dark grey, weathers dark grey, fine crystalline, 2 inch beds, argillaceous.
20-44	24	Interbedded limestone and dolomite, 2 inch beds.
44-55	11	Limestone - dark grey, weathers medium grey, crypto to fine crystalline, 4-6 inch beds, argillaceous.
55-190	135	Dolomite - dark to medium grey, weathers mottled dark to light grey, crypto to fine crystalline, 2-24 inch beds.

190-349	159	Dolomite - interbedded dark and medium grey, weathers dark and light grey, crypto to fine crystalline, 6-18 inch beds.
349-363	14	Limestone - dark grey, weathers yellowish grey, cryptocrystalline, 2 inch beds.
363-375	12	Dolomite - interbedded dark and light grey as at 190'.
375-376	1	Limestone - dark grey, weathers medium grey, cryptocrystalline, 10 inch beds.
376-565	189	Dolomite - dark grey, weathers light grey, interbedded with 15-20 foot units of medium grey dolomite weathering mottled medium and light grey, siliceous laminae throughout.
565-661	96	Dolomite - medium grey, weathers light brownish grey, fine crystalline, 1-2 foot beds, siliceous laminae.
661-714	53	Dolomite - interbedded dark grey and light grey, all weathering dark to light brownish grey, crypto to fine crystalline, 1-3 foot beds.
714-715	1	Dolomite - dark grey, fine crystalline, surface appears to be mudcracked.
715-811	96	Dolomite - dark to medium grey, weathers light grey to brownish grey, crypto to fine crystalline, 6-24 inch beds, siliceous laminae at 805' and 1 foot of penecontemporaneous breccia at 810'.
811-1033	222	Dolomite - interbedded dark and medium grey units which weather mottled dark grey and medium grey, fine crystalline, 8-24 inch beds, quartz and calcite lined vugs at 852'.
1033-1365	332	Dolomite - dark grey, weathers moderate brown, fine crystalline, 1-24 inch beds.
1365-1500	135	Limestone - dark grey, weathers greyish blue, cryptocrystalline, 1/8-2 inch beds, argillaceous.
1500-1502	2	Dolomite - dark grey, weathers dark grey, fine crystalline.

LOWER ORDOVICIAN

1502-1575	73	Limestone - dark grey, weathers greyish blue, 5-20 foot beds at 1575.
		Base - Limestone below, not measured but 2000 to 2500 feet estimated.

Section: South Haworth Lake DS-12

Age: Upper to Middle Ordovician

Location: North face of Little Cloudmaker Mountain three quarters of a mile north of section GS-10 at latitude 57°46'20" N. and longitude 125°07' W.

Stratigraphic Summary: Middle and Upper Ordovician graptolitic shales and siltstones conformably overlying Lower Ordovician limestone. Lower Silurian shales appear to conformably overlie the Ordovician and are exposed at the top of the mountain.

Measured by: D. Sykes and R. Tedrick, July 12, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER ORDOVICIAN	
Top 135-140	5	Siltstone - dark grey, weathers medium grey, argillaceous laminae, 4-6 inch beds.
140-170	30	Siltstone - dark grey, weathers medium grey, argillaceous and slightly calcareous, 6-8 inch beds.
170-300	130	Shale - dark grey, weathers orange to dark grey, 2-4 inch beds.
	MIDDLE ORDOVICIAN	
300-350	50	Shale - as at 170'.
350-400	50	Siltstone - dark grey, weathers orange to medium grey, with interbedded shale, 2-4 inch beds, cleaved.
400-440	40	Shale - dark grey, weathers dark grey.
440-490	50	Siltstone - brownish grey, weathers dark grey, fine laminae in upper 10 feet, lower 40 scree covered.

490-500	10	Sandstone - medium grey, weathers yellowish grey, very fine grained, argillaceous, laminated, 2-4 inch beds, with interbedded shale.
500-530	30	Covered interval.
530-702	172	Shale - dark grey, weathers brownish grey, 2-4 inch beds; at 567'-575' shale is interbedded with medium grey siltstone weathering medium grey to brown in 6-10 inch beds.
702-850	148	Siltstone - dark grey, weathers yellowish grey to orange, 6-10 inch beds, cleaved and rubbly.
		Base - Shale and siltstone not measured below but estimated at 400 feet, then limestone to the valley bottom.

Section: South Sikanni Chief River No. 1 DS-14

Age: Upper to Lower Ordovician

Location: Northwest face of Mount McCusker, immediately south of the Sikanni Chief River at latitude 57°10' N. and longitude 123°55' W.

Stratigraphic Summary: Fossiliferous Upper and Middle Ordovician exposed at surface and conformably overlying cleaved, Lower Ordovician limestones. Base of section obscured by stream debris.

Measured by: D. Sykes and R. Tedrick, July 21-24, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER AND MIDDLE ORDOVICIAN	
Top 0-55	55	Dolomite - medium grey, weathers light brown to pale reddish brown, very fine to fine crystalline, 6 inch-3 foot beds, argillaceous laminae throughout, quartz grains and chert blebs in lower 10 feet.
55-103	48	Dolomite - medium grey, weathers medium grey to pale brown, fine crystalline, 8-20 inch beds, argillaceous throughout, silica in fracture at 65' with "floating" sand grains 65'-70'.

103-198	95	Dolomite - light to medium grey, weathers yellowish grey to light grey, fine to medium crystalline, 4-12 inch beds, occasional siliceous stringers.
198-430	232	Dolomite - light to medium grey, weathers greyish pink to yellowish grey, very fine to fine crystalline, 6-8 inch beds 198'-229' then 1-3 foot beds 229'-430', siliceous stringers at 260'-355'.
430-670	240	Dolomite - medium grey, weathers pale brown, fine crystalline, 1-3 foot beds, rock composed mainly of algae.
670-910	240	Dolomite - medium grey, weathers light grey to pale brown, fine crystalline, 6 inch-3 foot beds, argillaceous throughout with siliceous stringers from 740'-890'.
910-960	50	Dolomite - medium grey, weathers light grey to pale brown, fine crystalline, 10-15 foot beds, argillaceous laminae throughout.
960-1100	140	Dolomite - medium grey, weathers medium to light grey, fine crystalline 960'-1075', medium crystalline 1075'-1100', abundant siliceous shell fragments and algae except 980'-1015' and 1028'-1042'.
1100-1110	10	Covered interval.
1110-1113	3	Dolomite - medium grey, weathers yellowish grey, fine crystalline, 3-8 inch beds.
1113-1145	32	Covered interval.
1145-1190	45	Dolomite - medium to light grey, weathers light grey to light brown, fine crystalline, 1-2 foot beds, argillaceous laminae.
1190-1250	60	Covered interval.
1250-1314	64	Dolomite - as at 1145' with siliceous stringers at 1250' and 4-6 inch calcareous beds from 1305'-1314'.
	LOWER ORDOVICIAN	
1314-1360	46	Limestone - medium grey, weathers light grey to yellowish grey, fine crystalline, 2-5 foot beds, argillaceous laminae; limestone may be traced laterally into dolomitic zones.

1360-1460	100	Covered interval.
1460-1650	190	Limestone - medium grey, weathers yellowish grey, very fine to fine crystalline, beds obscure, cleaved, and phyllitic; may be faulting here.
1650-1980	330	Limestone - medium grey, weathers light to medium grey, cryptocrystalline to fine crystalline, 3-20 foot beds, cleaved and phyllitic, residual weathering, argillaceous laminae throughout.
1980-2275	295	Limestone - dark to medium grey, weathers medium to light grey, cryptocrystalline to fine crystalline, 3-10 foot beds; poorly developed cleavage.
2275-2356	81	Limestone - as at 1980' but with argillaceous, residual weathering stringers.
2356-2510	154	Limestone - similar to above, but sporadic outcrop.
2510-2880	370	Limestone - medium to light grey, weathers bluish grey to yellowish grey, cryptocrystalline to fine crystalline, 1-10 foot beds, argillaceous laminae, ripple marks on bedding planes at 2620'; poorly developed cleavage.
2880-3435	555	Limestone - light to medium grey, weathers light grey to yellowish grey, very fine crystalline from 2880'-3140' and 3180'-3435', medium crystalline from 3140'-3180', 5-20 foot beds, numerous argillaceous laminae; weakly developed cleavage.
		Base of section obscured by talus.

Section: South Sikanni Chief River No. 2 DS-15

Age: Upper (?) Ordovician

Location: On strike of upper beds of section DS-14 ¼ mile south on Mount McCusker at latitude 57°09' N. and longitude 123°54'15"W.

Stratigraphic Summary: Unfossiliferous dolomite strata of questionable Upper Ordovician age. Appears to correlate from 436' section DS-15 to 0' of section DS-14. May be unconformably overlain by arenaceous Lower Silurian dolomite.

Measured by: D. Sykes and R. Tedrick July 25, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER (?) ORDOVICIAN	
Top 208-219	11	Dolomite -- dark to medium grey, weathers medium to light grey, very fine crystalline, 2-3 inch beds.
219-285	66	Dolomite - medium grey, weathers light grey to greyish orange, very fine to fine crystalline, 6-14 inch beds, silty laminae throughout.
285-365	80	Dolomite - as at 219' but lacking silty laminae, slightly arenaceous, 8-24 inch beds, interbedded with 2-4 inch beds of dolomitic sandstone.
365-436	71	Dolomite - light grey, weathers light brown, fine crystalline, 8-10 inch beds, slightly arenaceous.
		Base of section.

Section: North Akie River, DS-19

Age: Upper to Lower Ordovician

Location: Four miles north of the Akie River on the east slope of an unnamed mountain at latitude 57°21'30" N. and longitude 124°34'30" W.

Stratigraphic Summary: Lower Ordovician limestones covered by talus at the base and overlain conformably by graptolitic Middle and Upper Ordovician shales, siltstones and sandstones. Section is overlain conformably by Lower Silurian graptolitic shales and siltstones.

Measured by: D. Sykes, R. Tedrick and K. Samis, August 3, 4 and 8, 1961.

Stratigraphic Interval	Thickness (Feet)	Lithology
	UPPER ORDOVICIAN	
Top 750-770	20	Siltstone - pale brown, weathers light brownish grey, slightly calcareous.
770-805	35	Limestone - dark to medium grey, weathers light grey, fine crystalline, 6-10 inch beds.

805-815	10	Covered interval
815-836	21	Shale - pale brown, weathers medium to light grey.
836-840	4	Siltstone - medium grey, weathers yellowish grey, 6-8 inch beds.
840-845	5	Shale - black, weathers orange, 2-6 inch beds.
845-857	12	Dolomite - medium grey, weathers cream, fine crystalline, 6-8 inch beds, argillaceous.
857-882	25	Covered interval
882-895	13	Shale - dark grey, weathers orange, interbedded with siltstone, light grey, weathers orange, slightly arenaceous, 4-6 inch beds.
895-925	30	Quartzite - medium to light grey, weathers light grey to orange, fine to medium grained, siliceous matrix, 2-3 foot beds.
925-927	2	Siltstone - black, weathers light grey to orange, 2-4 inch beds.
927-978	51	Quartzite - medium to light grey, weathers light grey to orange, 2-3 foot beds.
978-985	7	Siltstone - black, weathers light grey to orange, 4-6 inch beds.
985-1000	15	Quartzite - medium to light grey, weathers light grey to orange, 4-6 foot beds.
1000-1002	2	Siltstone - as at 978'.
1002-1078	76	Quartzite - medium to light grey, weathers light grey to light brown, fine grained, 2-5 foot beds.
1078-1099	21	Siltstone - black to dark grey, weathers orange, interbedded with shale, black, weathers orange, bedding obscure.
1099-1105	6	Sandstone - medium to light grey, weathers dark grey, fine grained, 2-4 inch beds with occasional silty beds.
1105-1109	4	Shale - black, weathers orange, bedding obscure.

1109-1112	3	<u>Quartzite</u> - light brownish grey, weathers orange, fine grained.
1112-1151	39	<u>Shale</u> - dark grey, weathers orange, interbedded with sandstone, light bluish grey, weathers light grey, 2-6 inch beds.
1151-1224	73	<u>Quartzite</u> - medium to light grey, weathers light grey to moderate yellowish brown, fine grained, 3-8 foot beds.
1224-1305	81	<u>Shale</u> - black, weathers moderate yellowish brown, with 2 feet of quartzite at 1228' and interbedded shale and quartzite from 1235'-1305'.
1305-1415	110	<u>Sandstone</u> - pale brown, weathers pale brown, interbedded with shale and siltstone, 6-24 inch beds; crossbedding in sandstones at 1371'-1415'.
1415-1465	50	<u>Shale</u> - black, weathers dark grey to moderate yellowish orange, 6-8 inch beds, slightly calcareous and arenaceous near the base.
1465-1530	65	<u>Siltstone</u> - dark grey, weathers light grey, 3-4 foot beds.
	MIDDLE ORDOVICIAN	
1530-1605	75	<u>Shale</u> - black, weathers dark grey to greyish orange, 8-10 inch beds.
1605-1630	25	Covered interval.
1630-1755	125	<u>Siltstone</u> - dark to medium grey, weathers pale brown, 4-6 inch beds, silica in fractures from 1630'-1660'.
1755-1930	175	<u>Shale</u> - dark grey to dark brown, weathers medium to light brown, interbedded with siltstone, dark to medium grey, weathers orange, 4-8 inch beds.
1930-1975	45	<u>Siltstone</u> - dark to medium grey, weathers light brown, 4-10 inch beds, slightly arenaceous from 1930-1950' and fissile from 1950'-1975'.
1975-2005	30	<u>Shale</u> - dark grey, weathers moderate brown, interbedded with siltstone, dark to medium grey, weathers light brown, 6-8 inch beds.

LOWER ORDOVICIAN

2005-2075	70	Shale - as at 1975'.
2075-2174	99	Limestone - medium grey, weathers yellowish grey, very fine crystalline, 4-16 inch beds, intermittent zones of calcareous shale.
2174-2350	176	Limestone - dark grey, weathers medium grey to moderate yellowish brown, very fine crystalline 6-36 inch beds, occasional 4 inch zones of calcareous shale from 2174'-2208'.
2350-2475	125	Covered interval
2475-2570	95	Limestone - dark to medium grey, weathers medium grey to light brown, lithographic, 4-16 inch beds, argillaceous, calcite in fractures from 2505'-2535'.
2570-2635	65	Shale - medium grey to brownish grey, weathers moderate brown, beds obscure, very calcareous.
2635-2665	30	Limestone - dark to medium grey, weathers light grey, very fine crystalline, phyllitic, poorly developed cleavage.
		Base of section obscured by talus.

A P P E N D I X B

THIN SECTION DESCRIPTIONS

ROCK CLASSIFICATION

Rock classifications used in both the thin section (Appendix B) and insoluble residue (Appendix C) descriptions are based on the following publications:

Folk, R. L. (1957) Practical Petrographic Classification of Limestones, American Assoc. Pet. Geol. Bull., Vol. 43, No. 1.

Dunbar, C. O. and Rodgers, J. (1957) Principals of Stratigraphy, Wiley, New York.

Pettijohn, F. J. (1957) Sedimentary Rocks, Harper and Bros., New York.

A selected group of the terms employed by the writer are defined below.

1. Allochemical Constituents - Material formed by chemical or biochemical precipitation within the basin, but existing as discrete particles.

   a) Intraclasts - fragments of penecontemporaneous carbonate sediments eroded from adjacent parts of the basin.

   b) Fossils - all fossils except corals or algae growing in situ.

2. Orthochemical Constituents - All normal precipitates formed within the basin and showing little or no evidence of transportation.

3. Algal Dolomite - Rock composed mainly of algae and cemented with orthochemical material of any size, but of dolomitic composition.

4. Orthoquartzite - Rocks of particle size 1/16 to 2 mm. and consisting of greater than 90% quartz.

5. Protoquartzite - Rocks of particle size 1/16 to 2 mm. and containing more than 10% labile fragments.

6. Mudstone - Rocks of particle size less than 1/16 mm. and which are massive or blocky.

7. Shale - Rocks of particle size less than 1/16 mm. and which possess fissility.

Grain size limits for crystalline rocks are as follows:

Very coarsely crystalline	> 1 mm.
Coarsely crystalline	1/2-1 mm.
Medium crystalline	1/4-1/2 mm.
Finely crystalline	1/8-1/4 mm.

Very finely crystalline	1/16-1/8 mm.
Microcrystalline	1/256-1/16 mm.
Cryptocrystalline	< 1/256 mm.

THIN SECTION DESCRIPTIONS

Initial differentiation of the carbonate material was done with Alazarin Red dye, a preferential calcite stain. The thin section numbers refer to the section and the footage from which the sample was taken. Section locations are given in Appendix A.

Thin Section No. RT-1-1950

Composition
- Main Constituents
  - Calcite 67%
- Minor Constituents
  - Dolomite 25%
  - Pyrite 3%
  - Organic material 2%
  - Quartzite 3%

Texture
- Grain Size
  - Calcite .0015-.0825 mm. Average .0135 mm.
  - Dolomite .0030-.0900 mm. Average .0510 mm.
  - Pyrite irregular bodies less than .1800 mm.
  - Quartz .0345-.1104 mm. Average .0495
- Roundness
  - All crystals and grains angular.

Special Features

Single pellet of calcite crystals with central core of dolomite crystals.

Classification

Microcrystalline, dolomitic limestone.

Thin Section No. RT-1-2400

Composition
- Main Constituents
  - Calcite 90%
- Minor Constituents
  - Dolomite 7%
  - Pyrite 2%
  - Quartz 1%

Texture
- Grain Size
  - Calcite .0030-.0150 mm. Average .0105 mm.
  - Dolomite .0180-.0300 mm. Average .0240
  - Pyrite irregular bodies less than .0120 mm.
  - Quartz .0069-.0276 mm. Average .0172 mm.

Roundness
All crystals and grains angular.

Structure
Zone of "flowage" in the calcite shown by alignment of silt-sized material.

Special Features
Secondary calcite crystals showing twinning; unidentifiable pellet structures.

Classification
Microcrystalline limestone.

Thin Section No. RT-1-2750

Composition
Main Constituents
Calcite 80%
Minor Constituents
Dolomite 10%
Pyrite less than 1%
Organic material 7%
Quartz 3%

Texture
Grain Size
Calcite less than .0030 mm.
Dolomite .3100-.3450 mm. Average .3270 mm.
Pyrite irregular bodies less than .0150 mm.
Quartz .0138-.1794 mm. Average .0573 mm.
Roundness
All grains angular.

Structure
Intraclasts of dolomite and calcite crystals cemented by orthochemical dolomite and twinned calcite crystals.

Special Features
Abundant *Girvanella* "tubules" and shell fragments.

Classification
Cryptocrystalline, dolomitic limestone.

Thin Section No. RT-2-2500

Composition
Main Constituents
Calcite 85%
Minor Constituents
Dolomite 7%
Organic material 5%
Quartz 3%

Texture

Grain Size

Calcite .0015-.2250 mm. Average .0045 mm.

Dolomite .0405-.4830 mm. Average .0765 mm.

Quartz .0207-.2001 mm. Average .0897 mm.

Roundness

All grains angular.

Structure

Intraclasts of dolomite and calcite crystals cemented by ortho-chemical dolomite and twinned calcite crystals.

Special Features

Girvanella tubules (?) and shell fragments.

Classification

Very finely crystalline limestone.

Thin Section No. GS-4-1505

Composition

Main Constituents

Dolomite 60%

Minor Constituents

Pyrite 10%

Quartz 30%

Texture

Grain Size

Dolomite .0015-.0414 mm. Average .0285 mm.

Pyrite large irregular bodies and cubes less than .0690 mm.

Quartz .0276-.0828 mm. Average .0538 mm.

Roundness

Dolomite and calcite - angular; Quartz - angular to subrounded.

Classification

Microcrystalline argillaceous dolomite.

Thin Section No. GS-4-1521

Composition

Main Constituents

Calcite 60%

Minor Constituents

Dolomite 35%

Pyrite less than 1%

Quartz 5%

Texture

Grain Size

Calcite and dolomite .0165-.0270 mm. Average .0195 mm.

Pyrite irregular bodies less than .0390 mm.
Quartz .0207-.0828 mm. Average .0345 mm.
Roundness
Calcite and dolomite- angular; Quartz - angular to subrounded.

Structure
Some interpenetration between calcite and dolomite crystals.

Special Features
Numerous calcite crystals with dolomite rims; a few twinned calcite crystals present.

Classification
Microcrystalline, dolomitic limestone.

Thin Section No. GS-4-1805

Composition
Main Constituents
Dolomite 85%
Minor Constituents
Calcite 5%
Organic material 2%
Pyrite 1%
Quartz 7%

Texture
Grain Size
Dolomite .0345-.0759 mm. Average .0585 mm.
Calcite .0414-.1518 mm. Average .0869 mm.
Pyrite irregular bodies less than .0990 mm.
Quartz .0207-.0552 mm. Average .0317 mm.
Roundness
All crystals angular

Classification
Microcrystalline dolomite

Thin Section No. GS-4-1835

Composition
Main Constituents
Dolomite 87%
Minor Constituents
Calcite 3%
Pyrite 7%
Quartz 3%

Texture
Grain Size
Dolomite .0300-.0975 mm. Average .0345 mm.
Calcite .0900-.0975 mm. Average .0945 mm.

Pyrite irregular bodies less than .0910
Quartz .0276-.0828 mm. Average .0497 mm.
Roundness
All crystals angular

Classification
Microcrystalline dolomite.

Thin Section No. GS-10-2145

Composition
Main Constituents
Calcite 97%
Minor Constituents
Pyrite 3%

Texture
Grain Size
Calcite .0210-.2400 mm. Average .0540 mm.
Roundness
All crystals angular

Special Features
Vein quartz (.0660-.2400 mm.) cutting fine crystalline calcite (.0120-.0420 mm.).

Classification
Cryptocrystalline limestone

Thin Section No. GS-10-2270

Composition
Main Constituents
Calcite 90%
Minor Constituents
Dolomite 5%
Pyrite less than 1%
Organic material 3%
Quartz 2%

Texture
Grain Size
Calcite .0255-.0825 mm. Average .0525 mm.
Dolomite .0435-.0630 mm. Average .0570 mm.
Pyrite irregular bodies less than .0495 mm.
Quartz .0450-.0510 mm. Average .0465 mm.
Roundness
Calcite and dolomite - angular; Quartz - sub-angular.

Special Features

Abundant twinned calcite crystals with broad lamellae (up to .0180 mm.). Most lamellae are parallel, but some show "chevron" twinning. Algal "tubules" and algal (?) pellets in dolomite.

Classification

Microcrystalline dolomite.

Thin Section No. GS-13-2630

Composition

Main Constituents

Dolomite (algae) 50%

Dolomite (cement) 50%

Minor Constituents

Pyrite less than 1%

Quartz less than 1%

Texture

Grain Size

Dolomite (algal) .0201-.0750 mm. Average .0525 mm.

Dolomite (cement) .0180-.1080 mm. Average .0450 mm.

Pyrite irregular bodies less than .0360 mm.

Quartz .0138-.1518 mm. Average .0518 mm.

Roundness

Dolomite - angular; Quartz - angular to rounded.

Special Features

Algal bodies and cement both of about same crystal size, but cement is slightly coarser.

Classification

Microcrystalline algal dolomite.

Thin Section No. GS-13-2815

Composition

Main Constituents

Dolomite 60%

Minor Constituents

Pyrite 2%

Quartz 38%

Texture

Grain Size

Dolomite .0375-.0840 mm. Average .0555 mm.

Pyrite irregular bodies less than .1500 mm.

Quartz .0270-.2625 mm. Average .0621 mm.

Roundness

Dolomite - angular; Quartz - well rounded.

Special Features

Quartz grains show "cracked" surface as if shattered.

Classification
Microcrystalline, argillaceous dolomite.

Thin Section No. GS-13-3370

Composition
Main Constituents
Dolomite 65%
Minor Constituents
Pyrite 5%
Quartz 30%

Texture
Grain Size
Dolomite less than .0015 .0600 mm. Average .0022 mm.
Pyrite irregular bodies and cubes less than .0525 mm.
Quartz .0315-.0690 mm. Average .0510 mm.
Roundness
Dolomite angular
Pyrite cubes angular
Quartz well rounded

Special Features
Slide badly smeared during staining.

Classification
Cryptocrystalline, argillaceous dolomite.

Thin Section No. GS-14-2160

Composition
Main Constituents
Dolomite 80%
Minor Constituents
Pyrite 5%
Quartz 15%

Texture
Grain Size
Dolomite .0552-.3243 mm. Average .1518 mm.
Pyrite irregular bodies less than .2070 mm.
Quartz .0276-.1173 mm. Average .0559 mm.
Roundness
Dolomite - angular; Quartz - subangular to subrounded.

Classification
Very finely crystalline, argillaceous dolomite.

Thin Section No. GS-14-2515

Composition
Main Constituents
Dolomite (algal) 60%
Dolomite (cement) 40%
Minor Constituents
Pyrite less than 1%

Texture
Grain Size
Dolomite (algal) .0180-.0495 mm. Average .0354 mm.
Dolomite (cement) .0180-.0810 mm. Average .0645 mm.
Pyrite irregular bodies less than .0309 mm.
Roundness
All crystals angular

Special Features
Nuclei of algal bodies contains larger crystals than the rest of the algal body.

Classification
Microcrystalline, algal dolomite.

Thin Section No. GS-13-3330

Composition
Main Constituents
Dolomite 80%
Minor Constituents
Pyrite 5%
Quartz 15%

Texture
Grain Size
Dolomite .0690-.4830 mm. Average .1559 mm.
Pyrite irregular bodies less than .0510 mm.
Quartz .0345-.1242 mm. Average .0676 mm.
Roundness
Dolomite - angular; Quartz - subangular to subrounded.

Special Features
A few twinned dolomite crystals.

Classification
Very finely crystalline, arenaceous dolomite.

Thin Section No. DS-14-495

Composition
Main Constituents
Dolomite (algal) 35%
Dolomite (cement) 65%

Minor Constituents
Pyrite less than 1%
Quartz less than 1%

Texture
Grain Size
Dolomite (algal) .0330-.0480 mm. Average .0405 mm.
Dolomite (Cement) .0276-.0897 mm. Average .0675 mm.
Pyrite irregular bodies less than .0414 mm.
Quartz .0207-.2070 mm. Average .0690 mm.
Roundness
All crystals angular.

Special Features
Replaced core of one algae contains large (.3105-.5520 mm.) twinned dolomite crystals.

Classification
Microcrystalline, algal dolomite.

Thin Section No. DS-19-2245

Composition
Main Constituents
Calcite 80%
Minor Constituents
Dolomite 15%
Pyrite 5%
Quartz less than 1%

Texture
Grain Size
Calcite less than .0015 mm.
Dolomite less than .0015 mm.
Pyrite irregular bodies and cubes less than .0621 mm.
Quartz .0015-.0030 mm. Average .0025 mm.
Roundness
All crystals angular.

Structure
Scour and fill structure with alignment of organic (?) material or clay sized clastic particles accented by graded bedding.

Special Features
Stylolite seam through the calcite and parallel to the bedding.

Classification
Cryptocrystalline, dolomitic limestone.

Thin Section No. DS-14-2660

Composition

Main Constituents

Calcite 60%

Minor Constituents

Quartz 40%

Texture

Grain Size

Calcite .0828-.2346 mm. Average .1449 mm.

Quartz .0345-.1035 mm. Average .0676 mm.

Roundness

Calcite - angular; Quartz - angular to rounded.

Structure

Quartz concentrated in alternate layers of quartz and calcite then calcite.

Special Features

Abundant twinned calcite crystals.

Classification

Very finely crystalline, arenaceous limestone.

Thin Section No. GS-19-44

Composition

Main Constituents

Calcite 94%

Minor Constituents

Pyrite 1%

Quartz 5%

Texture

Grain Size

Calcite less than .0015 (except for twinned crystals)

Pyrite irregular bodies and cubes less than .0360 mm.

Quartz .0207-.0540 mm. Average .0355 mm.

Roundness

Calcite - angular; Quartz subrounded.

Special Features

A few twinned calcite crystals up to .3726 mm. in length which appear to be vug fillings from a nearby calcite vein.

Classification

Cryptocrystalline limestone.

Thin Section No. GS-19-870

Composition

Main Constituents
- Dolomite (algal) 45%
- Dolomite (cement) 50%

Minor Constituents
- Pyrite less than 1%
- Quartz 5%

Texture

Grain Size
- Dolomite (algal and cement) .0345-.4140 mm. Average .1083 mm.
- Pyrite irregular bodies less than .0345 mm.
- Quartz .0276-.0996 mm. Average .0496 mm.

Roundness
- Dolomite - angular; Quartz -subangular.

Special Features

Algal bodies cemented by dolomite crystals.

Classification

Very finely crystalline algal dolomite.

Thin Section No. GS-19-1365

Composition

Main Constituents
- Dolomite (algal) 60%
- Dolomite (cement) 37%

Minor Constituents
- Pyrite 3%
- Quartz less than 1%

Texture

Grain Size
- Dolomite (algal and cement) .0690-.2208 mm. Average .1248 mm.
- Pyrite irregular bodies less than .0690 mm.
- Quartz .0345-.0828 mm. Average .0496 mm.

Roundness
- All crystals angular

Special Features

Abundant twinned dolomite crystals. Many algae show radiating structure and a few algal "tubules" are present.

Classification

Finely crystalline algal dolomite.

A P P E N D I X C

INSOLUBLE RESIDUE DESCRIPTIONS

INSOLUBLE RESIDUE DESCRIPTIONS

A total of 454 randomly collected hand samples were examined for either insoluble residue or carbonate content. For dominantly carbonate rocks, a portion of each sample was placed in a cold 10% solution of hydrochloric acid to dissolve any carbonate minerals present. If the rock contained sufficient dolomite to inhibit dissolving, the acid and sample were heated to complete the process.

The residues were examined with a binocular microscope fitted with a four power objective and eight power oculars and the material comprising the residues was classified according to Wentworth's grain size scale. Because of the low magnifying power of the microscope, particles less than 1/16 mm. are termed mud. (For rock classification see Appendix B.)

For dominantly non-carbonate rocks, a simple qualitative test for a carbonate cement was made.

The amount of residue in the carbonate rocks generally was less than 20% but only the dominant grain size of the total residue was recorded.

Section	Sample (Footage from top)	Residue: Dominant Sizes	Residue: Estimated Per Cent of Residue	Rock Type
RT-1-61A	1795	mud	100	argillaceous limestone
	1800	very fine sand	60)	arenaceous limestone
		mud	40)	
	1850	very fine sand	60)	arenaceous limestone
		mud	40)	
	1900	mud	100	argillaceous limestone
	2000	mud	100	argillaceous limestone
	2050	mud	100	argillaceous limestone
	2100	no residue		limestone
	2150	fine sand	70)	arenaceous limestone
		mud	30)	
	2200	fine sand	80)	arenaceous limestone
		mud	20)	

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	2250	fine sand	80)	arenaceous limestone
		mud	20)	
	2300	no residue		limestone
	2350	mud	100	argillaceous limestone
	2400	mud	100	argillaceous limestone
	2500	mud	100	argillaceous limestone
	2550	mud	100	argillaceous limestone
	2600	mud	100	argillaceous limestone
	2650	very fine sand	60)	arenaceous limestone
		mud	40)	
	2700	no residue		limestone
	2850	very fine sand	60)	arenaceous limestone
		mud	40)	
	2900	no residue		limestone
	2980			protoquartzite
	3100			orthoquartzite
	3160			protoquartzite
	3200			protoquartzite
	3230			protoquartzite
	3300			protoquartzite
	3400			protoquartzite
	3500			orthoquartzite
	3600			protoquartzite
	3700			orthoquartzite
RT-2-61A	2240	mud	100	argillaceous limestone
	2260	mud	100	argillaceous limestone
	2280	mud	100	argillaceous limestone
	2300	mud	100	argillaceous limestone
	2320	very fine sand	70)	arenaceous limestone
		mud	30)	
	2340	mud	100	argillaceous limestone
	2360	mud	100	argillaceous limestone
	2380	very fine sand	40)	argillaceous limestone
		mud	60)	
	2400	very fine sand	40)	argillaceous limestone
		mud	60)	
	2440	very fine sand	35)	argillaceous limestone
		mud	65)	
	2460	mud	100	argillaceous limestone
	2512	mud	100	argillaceous limestone
	2535	mud	100	argillaceous limestone
	2540	mud	100	argillaceous limestone
	2580	mud	100	argillaceous limestone
	2640	mud	100	argillaceous limestone
	2680	mud	100	argillaceous limestone
	2715	mud	100	argillaceous limestone
	2835	very fine sand	65)	arenaceous limestone
		mud	35)	
	2840	very fine sand	50)	arenaceous limestone
		mud	50)	
	2845	very fine sand	50)	arenaceous limestone
		mud	50)	

	2870	no residue		orthoquartzite
	2910			protoquartzite
GS-4-61A	1540	mud	100	argillaceous limestone
	1550	mud	100	argillaceous limestone
	1580	mud	100	argillaceous limestone
	1590	mud	100	argillaceous limestone
	1610	mud	100	argillaceous limestone
	1640	mud	100	argillaceous limestone
	1650	mud	100	argillaceous limestone
	1664	mud	100	argillaceous limestone
	1680			mudstone
	1710	mud	100	argillaceous dolomite
	1745	mud	100	argillaceous dolomite
	1775	mud	100	argillaceous dolomite
	1861	mud	100	argillaceous limestone
	1900	mud	100	argillaceous limestone
	1930	mud	100	argillaceous limestone
	1950	mud	100	argillaceous dolomite
	1955	mud	100	argillaceous limestone
	1976	mud	100	argillaceous dolomite
	2000	mud	100	argillaceous limestone
	2025	mud	100	argillaceous limestone
	2050	mud	100	argillaceous limestone
	2075	mud	100	argillaceous limestone
	2100	mud	100	argillaceous limestone
	2125	mud	100	argillaceous limestone
	2150	mud	100	argillaceous limestone
	2175	mud	100	argillaceous limestone
	2200	mud	100	argillaceous limestone
GS-10-61A	1235			shale
	1290			shale
	1450			mudstone
	1500			mudstone
	1540			shale
	1610			shale
	1670	calcareous cement		shale
	1700			shale
	1750			shale
	1800			shale
	1850			shale
	1900			shale
	1935	calcareous cement		mudstone
	1950			shale
	2000	mud	100	argillaceous dolomite
	2025			shale
	2036			shale
	2075	mud	100	argillaceous dolomite
	2085			shale
	2120	mud	100	argillaceous dolomite
	2155			shale
	2200	mud	100	argillaceous limestone

	2220	calcareous cement		shale
	2300	calcareous cement		shale
	2345	mud	100	argillaceous limestone
	2420	calcareous cement		shale
	2500	mud	100	argillaceous limestone
	2620	mud	100	argillaceous limestone
	2700	mud	100	argillaceous limestone
	2800	mud	100	argillaceous limestone
	2900	mud	100	argillaceous limestone
GS-12-61A	1422	mud	100	argillaceous dolomite
	1440	fine sand	80)	arenaceous dolomite
		mud	20)	
	1441	mud	100	argillaceous dolomite
	1467	mud	100	argillaceous dolomite
	1475	mud	100	argillaceous dolomite
	1487	fine sand	80)	arenaceous dolomite
		mud	20)	
	1510	fine sand	75)	arenaceous dolomite
		mud	25)	
	1528			protoquartzite
	1659			protoquartzite
	1690	mud	100	argillaceous dolomite
	1725	mud	100	argillaceous dolomite
	1741	mud	100	argillaceous dolomite
	1775			protoquartzite
	1795	very fine sand	80)	arenaceous dolomite
		mud	20)	
	1840			protoquartzite
	1841			dolomite
	1870			dolomite
	1900	mud	100	argillaceous dolomite
	1944	fine sand	70)	arenaceous dolomite
		mud	30)	
	1992	mud	100	argillaceous dolomite
	2011	mud	100	argillaceous dolomite
	2021			protoquartzite
	2170			protoquartzite
	2200			protoquartzite
	2250	dolomitic cement		protoquartzite
	2280	dolomitic cement		protoquartzite
	2300			protoquartzite
	2330			protoquartzite
	2400	dolomitic cement		protoquartzite
	2428			protoquartzite
	2444	calcareous cement		protoquartzite
	2458			orthoquartzite
	2461	calcareous cement		protoquartzite
	2500	calcareous cement		protoquartzite
	2568	calcareous cement		protoquartzite
	2580	calcareous cement		protoquartzite
	2644	very fine sand	60)	arenaceous limestone
		mud	40)	

	2666	mud	100	argillaceous limestone
	2900	mud	100	argillaceous limestone
	2915	mud	100	argillaceous limestone
	3270	very fine sand	75)	arenaceous limestone
		mud	25)	
	3335	mud	100	argillaceous limestone
	3420	very fine sand	80)	arenaceous limestone
		mud	20)	
	3451	very fine sand	80)	arenaceous limestone
		mud	20)	
	3457	very fine sand	70)	arenaceous limestone
		mud	30)	
	3524	very fine sand	70)	arenaceous limestone
		mud	30)	
	3530	mud	100	argillaceous limestone
	3576	very fine sand	60)	arenaceous limestone
		mud	40)	
	3750	mud	100	argillaceous limestone
	3820	mud	100	argillaceous limestone
	3920	mud	100	argillaceous limestone
	3964			limestone
	3971	mud	100	argillaceous limestone
	3983	mud	100	argillaceous limestone
GS-13-61A	2230	mud	100	argillaceous dolomite
	2250	mud	100	argillaceous dolomite
	2320	mud	100	argillaceous dolomite
	2350	mud	100	argillaceous dolomite
	2360	mud	100	argillaceous dolomite
	2375	coarse sand	35)	argillaceous dolomite
		mud	65)	
	2480	medium sand	50)	arenaceous dolomite
		mud	50)	
	2490	mud	100	argillaceous dolomite
	2575	mud	100	argillaceous dolomite
	2600	mud	100	argillaceous dolomite
	2730	medium sand	75)	arenaceous dolomite
		mud	25)	
	2760	medium sand	75)	arenaceous dolomite
		mud	25)	
	2840	fine sand	70)	arenaceous dolomite
		mud	30)	
	2870	fine sand	70)	arenaceous dolomite
		mud	30)	
	2906	calcareous cement		protoquartzite
	2930	dolomitic cement		protoquartzite
	2960	dolomitic cement		protoquartzite
	2990	dolomitic cement		protoquartzite
	3020	dolomitic cement		protoquartzite
	3060	dolomitic cement		protoquartzite
	3090	dolomitic cement		protoquartzite
	3100			orthoquartzite
	3130	dolomitic cement		protoquartzite

	3160			protoquartzite
	3190			orthoquartzite
	3230			orthoquartzite
	3260	dolomitic cement		protoquartzite
	3310	dolomitic cement		protoquartzite
	3340	very fine sand	50)	arenaceous dolomite
		mud	50)	
	3400	mud	100	argillaceous limestone
	3430	mud	100	argillaceous limestone
	3460	mud	100	argillaceous limestone
	3495	mud	100	argillaceous limestone
	3520	mud	100	argillaceous limestone
	3564	mud	100	argillaceous limestone
GS-14-61A	2130	very fine sand	60)	arenaceous dolomite
		mud	40)	
	2225	mud	100	argillaceous dolomite
	2250	fine sand	80)	arenaceous dolomite
		mud	20)	
	2345	mud	100	argillaceous dolomite
	2380	mud	100	argillaceous dolomite
	2410	mud	100	argillaceous dolomite
	2483	mud	100	argillaceous dolomite
	2510	mud	100	argillaceous dolomite
	2550	mud	100	argillaceous dolomite
	2580	mud	100	argillaceous dolomite
	2640	mud	100	argillaceous dolomite
	2670	mud	100	argillaceous dolomite
	2700	mud	100	argillaceous dolomite
	2730	mud	100	argillaceous dolomite
	2760	mud	100	argillaceous dolomite
	2790	mud	100	argillaceous dolomite
	2850	mud	100	argillaceous dolomite
	2880	mud	100	argillaceous dolomite
	2910	mud	100	argillaceous dolomite
	2940	mud	100	argillaceous dolomite
	2970	mud	100	argillaceous dolomite
	3000	mud	100	argillaceous dolomite
	3030	mud	100	argillaceous dolomite
	3060	mud	100	argillaceous dolomite
	3090			dolomite
	3120			dolomite
	3150	mud	100	argillaceous dolomite
	3180	mud	100	argillaceous dolomite
	3210			dolomite
	3240			dolomite
	3270			dolomite
	3300	mud	100	argillaceous dolomite
	3360	mud	100	argillaceous dolomite
	3390	mud	100	argillaceous dolomite
	3410	mud	100	argillaceous dolomite

GS-18-61A	0	mud	100	argillaceous limestone
	50	mud	100	argillaceous limestone
	100	mud	100	argillaceous limestone
	150	mud	100	argillaceous limestone
	200	mud	100	argillaceous limestone
	250	mud	100	argillaceous limestone
	300	mud	100	argillaceous limestone
	350	mud	100	argillaceous limestone
	400	mud	100	argillaceous limestone
	450	mud	100	argillaceous limestone
	500	mud	100	argillaceous limestone
	550	mud	100	argillaceous limestone
	600	mud	100	argillaceous limestone
	650	mud	100	argillaceous limestone
	700	mud	100	argillaceous limestone
	750	mud	100	argillaceous limestone
	800	mud	100	argillaceous limestone
	900	mud	100	argillaceous limestone
	950	mud	100	argillaceous limestone
	1000	mud	100	argillaceous limestone
	1050	mud	100	argillaceous limestone
	1100	mud	100	argillaceous limestone
	1150	mud	100	argillaceous limestone
	1200	mud	100	argillaceous limestone
	1250	mud	100	argillaceous limestone
	1300	mud	100	argillaceous limestone
	1350	mud	100	argillaceous limestone
	1400	mud	100	argillaceous limestone
	1450	mud	100	argillaceous limestone
	1500	mud	100	argillaceous limestone
	1550	mud	100	argillaceous limestone
	1580	mud	100	argillaceous limestone
	1600	mud	100	argillaceous limestone
	1650	mud	100	argillaceous limestone
	1700	mud	100	argillaceous limestone
	1750	mud	100	argillaceous limestone
	1800	mud	100	argillaceous limestone
	1850	mud	100	argillaceous limestone
	1910	mud	100	argillaceous limestone
	1950	mud	100	argillaceous limestone
	2000	mud	100	argillaceous limestone
GS-19-61A	15	mud	100	argillaceous limestone
	79	mud	100	argillaceous dolomite
	80	mud	100	argillaceous dolomite
	100	mud	100	argillaceous dolomite
	125	mud	100	argillaceous dolomite
	200	mud	100	argillaceous dolomite
	215	mud	100	argillaceous dolomite
	300	mud	100	argillaceous dolomite
	375	mud	100	argillaceous limestone
	400	mud	100	argillaceous dolomite
	500	mud	100	argillaceous dolomite
	600	mud	100	argillaceous dolomite

	700	mud	100	argillaceous dolomite
	780	mud	100	argillaceous dolomite
	785	mud	100	argillaceous dolomite
	800	mud	100	argillaceous dolomite
	805	mud	100	argillaceous dolomite
	870	mud	100	argillaceous dolomite
	900	mud	100	argillaceous dolomite
	1000	mud	100	argillaceous dolomite
	1100	mud	100	argillaceous dolomite
	1205	mud	100	argillaceous dolomite
	1300	mud	100	argillaceous dolomite
	1400	mud	100	argillaceous limestone
DS-12-61A	135			mudstone
	145			mudstone
	210			shale
	350			mudstone
	450			mudstone
	499			protoquartzite
	545			shale
	567			shale
	625			shale
	780			protoquartzite
	810			protoquartzite
	850			protoquartzite
DS-14-61A	0	very fine sand	75)	arenaceous dolomite
		mud	25)	
	7	very fine sand	75)	arenaceous dolomite
		mud	25)	
	23	very fine sand	75)	arenaceous dolomite
		mud	25)	
	35	very fine sand	60)	arenaceous dolomite
		mud	40)	
	37	mud	100	argillaceous dolomite
	50	fine sand	75)	arenaceous dolomite
		mud	25)	
	55	mud	100	argillaceous dolomite
	66	very fine sand	80)	arenaceous dolomite
		mud	20)	
	78	mud	100	argillaceous dolomite
	84	mud	100	argillaceous dolomite
	100	fine sand	70)	arenaceous dolomite
		mud	30)	
	115	fine sand	70)	arenaceous dolomite
		mud	30)	
	117	fine sand	60)	arenaceous dolomite
		mud	40)	
	150	mud	100	argillaceous dolomite
	198	mud	100	argillaceous dolomite
	201	mud	100	argillaceous dolomite
	229	mud	100	argillaceous dolomite
	270	mud	100	argillaceous dolomite

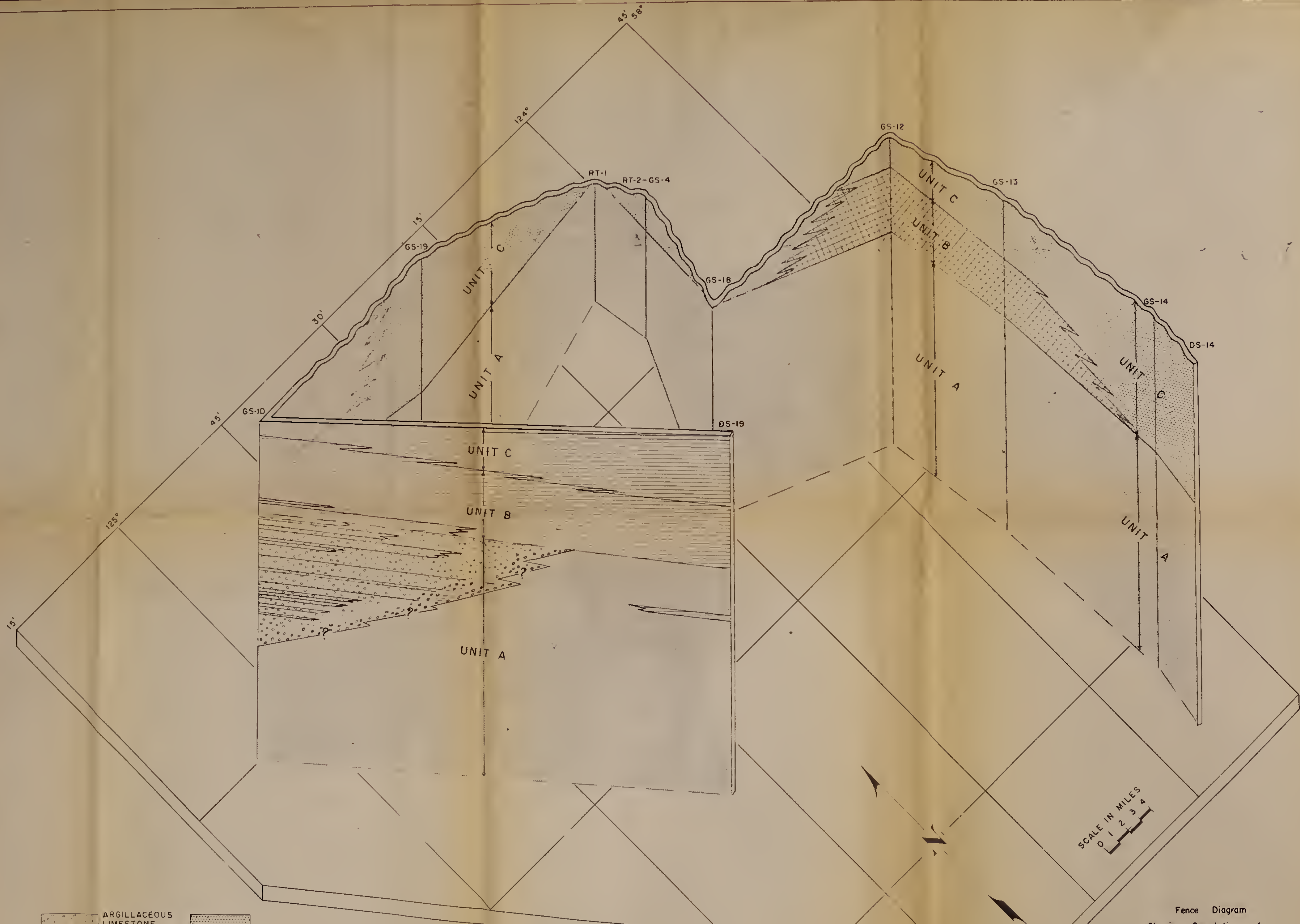
300	mud	100	argillaceous dolomite
315	mud	100	argillaceous dolomite
330	mud	100	argillaceous dolomite
360	mud	100	argillaceous dolomite
390	very fine sand	75)	arenaceous dolomite
	mud	25)	
430	mud	100	argillaceous dolomite
455	very fine sand	80)	arenaceous dolomite
	mud	20)	
460	mud	100	argillaceous dolomite
483	very fine sand	60)	arenaceous dolomite
	mud	40)	
490	mud	100	argillaceous dolomite
495	mud	100	argillaceous dolomite
496	very fine sand	75)	arenaceous dolomite
	mud	25)	
520	very fine sand	75)	arenaceous dolomite
	mud	25)	
550	very fine sand	75)	arenaceous dolomite
	mud	25)	
590	very fine sand	60)	arenaceous dolomite
	mud	40)	
625	very fine sand	60)	arenaceous dolomite
	mud	40)	
660	very fine sand	60)	arenaceous dolomite
	mud	40)	
685	very fine sand	50)	arenaceous dolomite
	mud	50)	
690	very fine sand	30)	argillaceous dolomite
	mud	70)	
720	mud	100	argillaceous dolomite
760	mud	100	argillaceous dolomite
820	mud	100	argillaceous dolomite
850	mud	100	argillaceous dolomite
880	mud	100	argillaceous dolomite
890	mud	100	argillaceous dolomite
910	mud	100	argillaceous dolomite
940	very fine sand	70)	arenaceous dolomite
	mud	30)	
970	very fine sand	70)	arenaceous dolomite
	mud	30)	
1000	very fine sand	70)	arenaceous dolomite
	mud	30)	
1030	mud	100	argillaceous dolomite
1060	very fine sand	40)	argillaceous dolomite
	mud	60)	
1074	very fine sand	40)	argillaceous dolomite
	mud	60)	
1090	very fine sand	50)	argillaceous dolomite
	mud	50)	
1100	very fine sand	40)	argillaceous dolomite
	mud	60)	
1160	mud	100	argillaceous dolomite

1250	mud	100	argillaceous dolomite
1280	mud	100	argillaceous dolomite
1310	mud	100	argillaceous dolomite
1314	mud	100	argillaceous limestone
1340	mud	100	argillaceous limestone
1380	very fine sand	30)	argillaceous limestone
	mud	70)	
1475	mud	100	argillaceous limestone
1525	mud	100	argillaceous limestone
1560	mud	100	argillaceous limestone
1600	mud	100	argillaceous limestone
1650	mud	100	argillaceous limestone
1655	mud	100	argillaceous limestone
1700	mud	100	argillaceous limestone
1750	mud	100	argillaceous limestone
1800	mud	100	argillaceous limestone
1850	mud	100	argillaceous limestone
1907	mud	100	argillaceous limestone
1955	mud	100	argillaceous limestone
2005	mud	100	argillaceous limestone
2100	mud	100	argillaceous limestone
2150	mud	100	argillaceous limestone
2200	mud	100	argillaceous limestone
2210	mud	100	argillaceous limestone
2250	mud	100	argillaceous limestone
2300	mud	100	argillaceous limestone
2356	mud	100	argillaceous limestone
2420	mud	100	argillaceous limestone
2465	mud	100	argillaceous limestone
2510	mud	100	argillaceous limestone
2550	mud	100	argillaceous limestone
2580	mud	100	argillaceous limestone
2600	mud	100	argillaceous limestone
2610	mud	100	argillaceous limestone
2650	mud	100	argillaceous limestone
2660	mud	100	argillaceous limestone
2700	mud	100	argillaceous limestone
2750	mud	100	argillaceous limestone
2800	mud	100	argillaceous limestone
2850	very fine sand	40)	argillaceous limestone
	mud	60)	
2900	mud	100	argillaceous limestone
2950	mud	100	argillaceous limestone
2980	mud	100	argillaceous limestone
3000	mud	100	argillaceous limestone
3050	mud	100	argillaceous limestone
3100	mud	100	argillaceous limestone
3150	mud	100	argillaceous limestone
3160	mud	100	argillaceous limestone
3200	mud	100	argillaceous limestone
3300	mud	100	argillaceous limestone
3350	mud	100	argillaceous limestone
3400	mud	100	argillaceous limestone
3435	mud	100	argillaceous limestone

DS-15-61A	214	mud	100	argillaceous dolomite
	219	mud	100	argillaceous dolomite
	225	very fine sand	60)	arenaceous dolomite
		mud	40)	
	245	fine sand	75)	arenaceous dolomite
		mud	25)	
	260	fine sand	75)	arenaceous dolomite
		mud	25)	
	350	fine sand	75)	arenaceous dolomite
		mud	25)	
	365	very fine sand	70)	arenaceous dolomite
		mud	30)	
	398	very fine sand	70)	arenaceous dolomite
		mud	30)	
DS-19-61A	750	mud	100	argillaceous limestone
	773	mud	100	argillaceous limestone
	835			mudstone
	882			shale
	894			shale
	895			orthoquartzite
	900			orthoquartzite
	920			orthoquartzite
	925			mudstone
	927			orthoquartzite
	940			orthoquartzite
	960			orthoquartzite
	980			mudstone
	1000			mudstone
	1040			mudstone
	1078			mudstone
	1100			mudstone
	1106			shale
	1109			shale
	1120			shale
	1140			protoquartzite
	1180			orthoquartzite
	1220			orthoquartzite
	1250			shale
	1280			shale
	1300			protoquartzite
	1330			protoquartzite
	1340			protoquartzite
	1360			protoquartzite
	1380			protoquartzite
	1381			protoquartzite
	1400			protoquartzite
	1420			shale
	1450			shale
	1480			mudstone
	1500			mudstone
	1530			shale
	1560			shale
	1600			shale
	1630			mudstone

1690	calcareous cement		mudstone
1730	calcareous cement		mudstone
1760			shale
1800			shale
1840			shale
1880			shale
1930			mudstone
1955			mudstone
1960			mudstone
2027			mudstone
2080	mud	100	argillaceous limestone
2100	mud	100	argillaceous limestone
2120	mud	100	argillaceous limestone
2160	mud	100	argillaceous limestone
2165	mud	100	argillaceous limestone
2170	mud	100	argillaceous limestone
2200	mud	100	argillaceous limestone
2240	mud	100	argillaceous limestone
2261	mud	100	argillaceous limestone
2288	mud	100	argillaceous limestone
2311	mud	100	argillaceous limestone
2475	mud	100	argillaceous limestone
2510	mud	100	argillaceous limestone
2540	mud	100	argillaceous limestone
2565	mud	100	argillaceous limestone
2600	calcareous cement		shale
2635	mud	100	argillaceous limestone


GEOLOGIC MAP O
PROPHET RIVER
BRITISH COLUM
MILES
0
5
SCALE
LEGEND
Geologic boundary (established; inferred)
Fault (established; inferred)
Anticline (normal; overturned)
Syncline (normal; overturned)
Bedding (inclined, overturned, vertical, horizontal, contorted)
RT-1 Section location
Drainage
Δ7630 Bench Mark
125°15'
125°00'
124°45'
125°30'
125°15'
124°00'
123°45'
MT LLOYD GEORGE
Kwadacha River
Muskwa River
Prophet River
Structurally Complex Western Thrust
Frontal Thrust
Western Thrust
GREAT SNOW MTN
CYCLOPS
MT HELEN
MT McCUSKER
Akie River
Ospika River
Sikanni
PЄ
Cu
Ok
Op
DS-12
GS-10
GS-13
GS-18
GS-4
GS-12
GS-13
GS-14
GS-16
DS-14
DS-15
DS-19
RT-1
RT-2
RT-4



Fence Diagram
Showing Correlation of